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Photovoltaic array on Georgetown University's Intercultural Center, page 20. Photo by Charles Feil.

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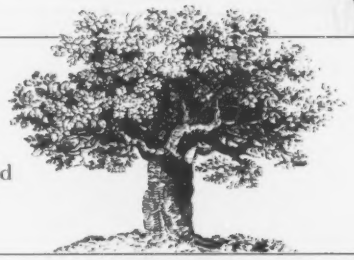

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MANAGING NUCLEAR WASTE

A 'remarkable piece of legislation' finally provides a plan for the nation's first permanent repository for spent reactor fuel.

For decades, spent nuclear fuel containing high-level radioactive waste from the nation's nuclear power generating facilities has been in "temporary" storage at individual reactor sites while federal government plans for promised long-term storage and commercial waste reprocessing have come and gone. Many utilities now are running out of storage space. Current estimates are that, by the year 2000, commercial nuclear reactors will have produced some 49,500 metric tons of spent fuel—almost 5 times more than exists at present.

Recognizing the growing severity of the nation's nuclear waste storage problem, in December 1982 Congress passed the Nuclear Waste Policy Act of 1982 (NWPA). It authorizes the Department of Energy (DOE) to plan and build the first permanent geologic repository for commercial nuclear waste in the United States by 1998. The entire $20 billion plus cost of the project, expected to be the largest civil works project in the nation's history, will fall to the ratepayers of those electric utilities that own and operate nuclear power plants.

Because the electric utility industry and its customers have such a large stake in this project and its outcome, the Utility Nuclear Waste Management Group (UNWMG), an industry organization that includes 41 utility members and three allied associations, is stepping up its activities related to the implementation of the law. Recently, Washington, D.C., freelance writer Leslie Braunstein talked with James B. Hall, Program Manager of the UNWMG, to get his perspective on the progress and implications of the project. A recently retired U.S. Army Colonel, Hall spent much of his 26-year military career managing construction projects worldwide for the Corps of Engineers. He joined UNWMG in May of this year.

EP: What are the government's current plans for dealing with commercial nuclear waste?

Hall: Since the mid-1950s, the federal government has considered plans to dispose of high-level radioactive wastes in deep, stable geological formations. Those plans, however, met with less than complete acceptance by federal, state, and industry representatives who kept looking to alternatives to geologic disposal, such as space and ocean disposal. Now, however, there is the Nuclear Waste Policy Act of 1982. Passed by a lame duck Congress without a conference, it is a remarkable piece of legislation.

The law codifies the geologic disposal technology. It calls for the Department of Energy (DOE) to form an Office of Civilian Radioactive Waste Management, with a Presidentially appointed director reporting directly to the Secretary of Energy and responsible solely for waste disposal. After two acting directors, Robert Morgan and Michael Lawrence, Benjamin Rusche was recently confirmed as director of that office. He is now assembling his staff. Rusche served for many years with DuPont and also as the Nuclear Regulatory Commission's (NRC) Director of Reactor Regulations.

In addition to establishing the office, DOE was to issue a mis-

Utility Nuclear Waste Management Group Program Manager James B. Hall

sion plan providing a schedule for building the nation's first geologic repository by 1998. A preliminary version of a mission plan was distributed on December 28, 1983. DOE issued a more comprehensive two-volume Draft Mission Plan on May 8 of this year, calling for comments to be submitted by July 9. We submitted a 41-page comment. I understand the Department received about 3,000 comments on individual items altogether. DOE must address and evaluate all of these comments, and then finalize the mission plan. The finalized mission plan was originally scheduled to come out in August or September; now it's not expected until the end of the year.

EP: What happens after that?
Hall: Before the repository is built, a site must be selected. Based on previous studies, nine sites are under consideration for the first repository. DOE must nominate five sites and then recommend three sites to the President by January 1985 for site characterization. After DOE conducts characterization studies on each of the three sites, the President is to make a final site recommendation to Congress. Although the NWPA called for the recommendation by 1987, the current mission plan allows for the final site selection to slip until 1990. We're urging DOE to try to meet a date close to the 1987 date mandated by the legislation.

EP: Where are the nine candidate sites?

Hall: There are three potentially acceptable sites in salt domes located just north of the Gulf of Mexico. Two are in Mississippi and one is in Louisiana. Then there are two in north Texas salt formations known as the Palo Duro Basin. Two more are in Utah's Paradox Basin salt formations in the southeast part of the state. The other two are in different types of stable geological formations on federal government lands, one at the Nevada Test Site and one at the Hanford Site in southeast Washington state.

EP: Will there be objections to the site selection?
Hall: Very likely. DOE is supposed to work with state governments and Indian tribes during the site selection process. When the final site selection is made, the state can object and such an objection will stand unless both houses of Congress override the objection. States are likely to object. We've already seen states delaying the process in the development of site selection guidelines. The law called for DOE to obtain NRC concurrence of its draft site selection guidelines within six months. This NRC concurrence took one year—not six months. A major contributing factor to this delay was the large number of objections raised by the states in their review of the draft guidelines.

EP: Don't some localities actually want the repository?
Hall: The "Nimby" factor—"not in my back yard"—lives on. For example, many people living in Richland, Washington—near the Hanford Site—would support the repository. They've lived with nuclear energy for years. They know it brings in money and jobs, and they believe it's safe. But the state government objects. From a political standpoint, every governor is under much pressure from many opposing interests to object. Such pressure is hard to ignore, especially if supporters are not as numerous or as vocal as objectors.

EP: In recent years, public opposition to nuclear energy has caused major difficulties for the industry. Could the repository spark opposition along the lines of protests at Diablo Canyon?
Hall: The repository could very well incite public protest on an even greater scale than have Diablo Canyon and other nuclear power plants. There are a lot of nuclear power plants under construction, but the repository will be a single facility. As such, it will allow people to focus their anxieties on a single location. It could become quite a public concern and a media event. Are people going to lay down in the middle of the street to prevent equipment from getting through? Who knows? We

Most of the American public doesn't know about the Nuclear Waste Policy Act.

can only hope that citizens will accept this project as a necessary solution to an important problem.

EP: How much does the public really know about this project?
Hall: Most of the American public doesn't know about the Nuclear Waste Policy Act. And much of the information that they will receive about it will be biased. The media will continue to raise the question, "How can we be assured that this waste will be stored safely for a million years?" There will always be a fraction of the public who will argue with our position. Investor-owned utilities will look to the Committee on Energy Awareness to develop a positive public information program.

Most of us think that the nuclear waste problem is exaggerated—at least as far as the technical difficulty of a solution is concerned. All of the spent fuel generated by commercial reactors by the year 2000 could be stored safely in a water basin no larger than the Lincoln Memorial reflecting pool. Of course, we will need to make sure that the proper safeguards for geologic repositories are in place. Nor should we minimize the difficulty of the political and institutional problems likely to be encountered.

EP: Since there is a possibility that the repository construction schedule will slip, what will utilities do with their accumulating nuclear waste?
Hall: The legislation is not clear on this subject. DOE states in the mission plan that it feels obligated to take title to utilities' high-level waste beginning in 1998, whether or not the repository is ready. There are several ways in which DOE could handle this waste. It could be stored at the future repository site or in transportable casks at the reactor sites. A third option, specified in both the legislation and the mission plan, is to store the waste for up to several decades in an interim monitored retrievable storage (MRS) facility. If the geologic repository is delayed significantly—DOE doesn't specify the exact number of years—then the Department may decide to build one or more MRS facilities. Using MRS, the Department could retrieve the waste sometime in the future, while safeguarding it in the present. Such facilities might add to the total cost of the nuclear waste management program because DOE would need to select another site and build another facility. DOE is studying the use of an MRS right now and will submit its study results to Congress in June 1985.

EP: How is the nuclear waste repository being financed?
Hall: The legislation calls for the program to be "full cost-recovery funded" by monies provided to the federal government from those who generate nuclear waste. In other words, utilities have to pay for their own waste disposal. The law required all waste generators to contract with DOE for disposal by June 30, 1983. That's one part of the legislation which has proceeded according to schedule—all current waste producers now have signed. There were 70 contracts signed covering 80 nuclear reactors. If a utility had

POTENTIALLY ACCEPTABLE SITES FOR THE FIRST REPOSITORY

missed the contracting deadline, NRC could have withdrawn its operating license. Any new nuclear power plant that comes on line must sign the contract with DOE when it starts producing nuclear waste.

The rate of payment is one mill per kilowatt-hour of electricity generated by the nuclear power plant. Contracted utilities are now paying about $300 million per year. This amount will increase as new nuclear power plants come on line, up to about $500 million per year. That s a great deal of money. It's handled as a fuel cost and paid on a running basis like a gasoline tax—those who get the benefits of nuclear power must pay the costs of disposal. Of course, any unnecessary delays in the schedule will only add to the cost of the program.

Our concern is that utilities and their ratepayers are paying for a service that will not be provided for 14 or 15 years, maybe longer. Our members are paying in good faith. Their plans for storing waste at reactor sites are predicated on the DOE service being available by 1998 or thereabouts. Right now the $300 million is paying for a whole host of programs—research, administrative and overhead costs, developing environmental assessments for the nine sites, providing a basis for site characterization, looking into casks for transporting and storing nuclear materials, and so on.

EP: What is the extent of UNWMG's involvement with the project?

Hall: Because our members are providing the money to obtain a service, we have two concerns: (1) that the program proceed expeditiously and be available when promised, and (2) that the ratepayers' money be spent efficiently and effectively. To address these concerns, UNWMG actively oversees DOE's implementation of the Nuclear Waste Policy Act. In existence since 1976, this group includes both investor-owned utilities and non-investor-owned utilities which operate nuclear power plants, along with Edison Electric Institute, The American Public Power Association, and the National Rural Electric Cooperative Association. We supported passage of the waste policy legislation, and after it was passed last year, we focused on the implementation of the law. For instance, we went before the NRC to urge its concurrence with the DOE site selection guidelines.

We focus two-thirds of our budgeted effort on implementation of the 1982 Act, which covers high-level waste, and one-third of our effort on the 1980 law that covers disposal of low-level radioactive wastes. Low-level waste is defined as all radioactive waste except spent fuel, reprocessing waste, and waste contaminated with transuranic elements—things such as clothing, resins, or dead animals, which came from both nuclear power plants and medical/research facilities. One of our tasks with the high-level waste program is overseeing the contracts signed between DOE and waste producers. We interact frequently with DOE, NRC, and the Environmental Protection Agency (EPA) on behalf of member utilities. We are a constructive critic—reviewing, making suggestions, and so on. In the future, we expect to be more active in the regional programs.

Recently we have provided input to DOE in developing the repository site selection guidelines and in seeking modifications of the standard DOE/utility contract for waste disposal. We've had extensive interactions, both formal and informal, with DOE regarding its implementation of the repository program and management of the waste fund. We've provided informal input to EPA when it was developing its high-level waste disposal standards. In addition, we've worked extensively with NRC in regard to rules for spent fuel storage.

EP: You're concerned with the total cost of the project and how the money is being spent. How much will the repository cost, and how much of that could be considered direct cost?

Hall: We don't have detailed cost figures yet, but the latest estimates of the repository's total cost range from $19 to $25 billion, making it the most expen-

sive civil works project in the nation's history. Only about $7 billion of that total is earmarked for life cycle costs of the first repository. Development and evaluation costs also are expected to be at least $7 billion. Much of the total cost will go for litigation and research. We don't argue the need for research; we simply ask, "How much is needed to meet our goals?"

EP: Considering the tremendous differences between the original cost estimates and final costs of recently built nuclear power plants, don't you think that the repository will be subject to the same kind of virtually uncontrollable cost escalation?
Hall: If we were to proceed rapidly with construction of the repository, and not spend so much on research and development, the amount currently budgeted would be generous. This isn't a high-temperature or high-pressure system; it's based on digging holes in the ground. But right now the facility is not even designed—we're still selecting a site. The numbers that we have are as good as DOE can come up with right now. If the cost does go up, the utilities will pay more. The law provides DOE with an opportunity to adjust the fee for its waste management services. We hope that by good management and adherence to the schedule, costs can be controlled.

EP: UNWMG and Edison Electric Institute jointly submitted comments on the draft mission plan to DOE. What were some of

your major concerns?
Hall: One of our main concerns is that the mission plan contains no clear waste acceptance schedule—one that details what services a utility can receive for the money it's paying. We would like an unequivocal statement regarding DOE's obligation to dispose of the nuclear waste. Utilities need to plan in advance for waste storage, and they need to know just what the government will take and when it will take it. When DOE does take title to the waste, we want them to take it away from the reactor sites.

EP: Can DOE make such an unequivocal promise if it isn't sure when the repository will be finished?
Hall: I think we should start with the premise that the 1998 goal is clearly achievable. From the utilities' standpoint, we would like to see that goal pursued, with the view that all these institutional problems will not be allowed to delay the project. If you start with the premise that there will be delay, then it becomes a self-fulfilling prophecy. Our comments urge DOE to try every possible means of achieving the goal established by Congress. With that timeline set and the funding mechanism established, the only remaining issues are the strategy and methodology by which DOE attempts to meet its goals. We suggest using a systems optimization approach: adopting the approach that offers the best chance of success. You can plan to build the Taj Mahal or you can build a useful, workable structure. For instance, DOE probably could move a lot more rapidly by choosing those technically acceptable sites affording the greatest degree of public acceptance. That type of choice would speed up the process of obtaining permits and proceeding through the licensing process. Similarly, we are urging DOE to avoid spending too much time and money on site characterization; close coordination with the NRC will help greatly in that regard. These sites have been studied previously, some more than others. At one time, they even had begun test drilling at Hanford. The concept of geologic disposal is not new, either here or overseas. I think that Congress realized the necessity of sticking to a schedule when it made the Waste Policy Act so specific. I'm not aware of any other Congressionally mandated construction program that is as specific as this Act.

EP: Despite the Congressionally mandated deadline, the program is already delayed. What delays have occurred so far? Do you think that they can be overcome?
Hall: As I mentioned, NRC recently approved site selection guidelines after one year rather

I personally think that the project deadline mandated by Congress could be met...

than six months. The Project Decision Schedule is needed now, and I understand DOE is working on that schedule. However, you must have a plan before you have a schedule, and they have not finalized or specified their plan. The revised mission plan is not expected until the end of the year. Perhaps most importantly, though, DOE has said in the latest draft mission plan that it expects a delay of three years in completing site characterization and selecting the first site—from 1987 to 1990. Obviously this delays the entire program. I personally think that the project deadline mandated by Congress could be met, but such projected delays this early aren't encouraging.

EP: What about licensing? Won't it be problematical to license a prototype facility?

Hall: DOE and NRC will be cooperating to determine the arrangements for licensing the repository. The process will be complex to ensure that safeguards are met. It is important that close coordination between DOE and NRC is established early and maintained. DOE is not familiar with the licensing process because its defense nuclear waste work does not require licensing. We said in our comments that is not too early for DOE and NRC to begin planning and cooperating for the licensing process.

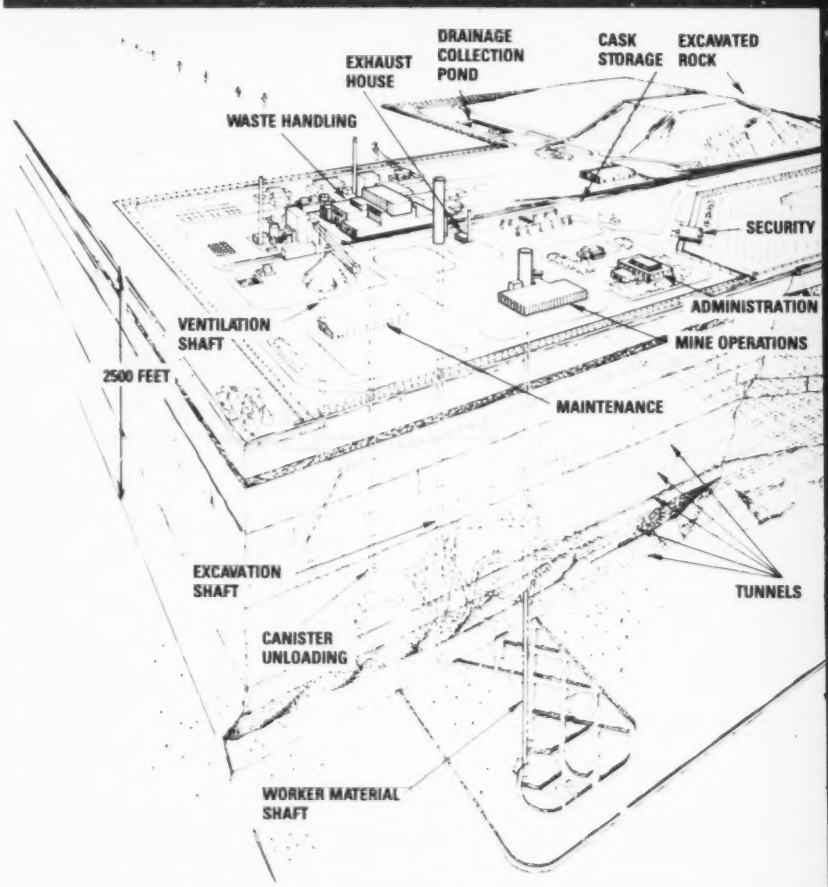
EP: Does the plan for disposing of commercial nuclear waste affect defense nuclear waste?

Hall: The commercial repository may take in defense nuclear waste as well. According to the Nuclear Waste Policy Act, the President must inform Congress by January 1985 whether or not defense waste needs to be stored separately. If the President is unable to justify the need to store defense waste separately, then the Department of Defense will use the DOE repository and share its cost. The current volume of defense waste exceeds that of commercial waste, but its total radioactivity is less.

EP: When DOE implements a new technology, it usually has test and demonstration projects. Why did DOE decide to skip this step with the repository program? And why did it opt for one nationwide repository rather than several decentralized ones?

Hall: The current mission plan does not call for a test or demonstration facility. The Nuclear Waste Policy Act authorized DOE to build a deep geologic

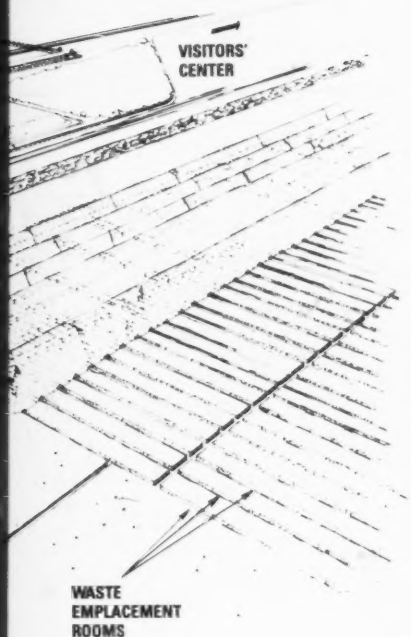
ARTIST CONCEPT OF REPOSITORY SURFACE SUPPORT AND UNDERGROUND FACILITIES



. . . most of the effort will involve application of known technologies.

Test and Evaluation Facility, but did not require the Department to do so. In the mission plan draft, DOE has concluded that a separate testing facility is not needed. If the Department does decide to build one, it will probably be at the repository site. That decision should come by 1987.

DOE still has not determined at this early date how many repositories might ultimately be required. Although the program is heavily focused on completing the first repository, the Act actually requires two repositories to be built—the first by 1998 and the second after the year 2000. Will one be in the East and one in the West? Will they both be in the same area? Such questions remain to be answered. From a transportation standpoint, it would seem to make sense to have the repository located as close as possible to the area where the most nuclear waste is generated. Minimizing the distance between reactor sites and repository could cut transportation costs dramatically. Most of the nation's nuclear power is generated in the industrial and heavily populated Northeast. But many other factors must be considered in the site selection process—geo-technical considerations, environmental impacts, socio-economic impacts, public acceptance, political considerations, to name a few.



EP: What will the permanent repository actually be like? How much waste will it hold?

Hall: The repository will consist of a series of deep underground caverns whittled out of rock, one-quarter to one-half mile under the surface. Waste canisters will be placed in the caverns, and then the caverns will be backfilled. At the surface there will be facilities for receiving, handling, and emplacing the waste in the underground disposal rooms. Depending on the type of transport and disposal canisters used, there also might be facilities for consolidating or repackaging the waste. When the repository has been filled to capacity, the surface facilities will be decommissioned, and the repository sealed permanently.

The Act requires that the second repository be in operation before the first repository exceeds 70,000 metric tons of heavy metal in spent nuclear fuel, or the quantity of high level-waste resulting from the reprocessing of such a quantity of spent nuclear fuel. Current estimates indicate that the second repository would begin operation about six years after the first repository. It too, would have a planned 70,000-metric-ton capacity. The two repositories would accomodate all commercial wastes anticipated to be generated by 2020.

EP: Will new technology be required to store and safeguard the waste?

Hall: We will need some basic research to find the right package to contain the waste in a geologic structure over many years. We will need to study the effects of radioactivity on rock over a long period of time. But most of the effort will involve application of known technologies. We've been building hot cells for packaging radioactive material for 30 years. And as for the disposal techniques themselves, it's really just underground mining in reverse. We don't have to invent anything for mining and digging. It's not "high-tech." And while a repository will create some jobs, most won't be high-tech jobs.

CANCER IN THE GARDEN OF EDEN

'... despite abundant scientific evidence of natural carcinogens, governmental agencies fail to report on most of them and instead issue warnings only about industrial carcinogens.'

By Edith Efron

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For several decades—since the publication of *Silent Spring* by Rachel Carson—our nation's efforts to combat cancer have been dominated by a religious-political view of man, nature, and society. I call the environmental scientists and government regulators who adhere to this ideology "The Apocalyptics," in that, with little or no data, they have ceaselessly projected the catastrophic destruction of life on earth by industrial civilization. Where apocalyptics are concerned, cancer is fundamentally a modern moral and political disease caused by the human evils of intellectual arrogance and greed. Ninety percent of it, they have said, comes from "the Faustian sin"; from man's arrogant conquest of nature; from post-World War II science, technology, economic growth, and affluence; from the primary values of the Industrial Revolution and Western civilization and, not infrequently, from capitalism, the market, and profits. Carcinogens, the apocalyptics have said, are predominantly synthetic substances, almost never to be found in nature, and are primarily industrial artifacts. Industrialized America, they have told us for 20 years, is a carcinogenic hell.

The apocalyptics' theory of cancer is an ideological fairy tale, and it clearly emerged from scientists who had not read the literature of their field. Nothing demonstrates this more dramatically than the enormous body of nonapocalyptic literature which has been accumulating since the 1920s, indicating that nature itself is teeming with carcinogens as well as with substances that damage genetic material, known as mutagens. Even as Americans were being taught in the 1960s and 1970s that industry was despoiling the Garden of Eden, the scientific literature was indicating that the planet is permeated with materials that are reported in laboratory tests to cause cancer and mutation: radiation, minerals, metals, volcanic aerosols, fossils, viruses, bacteria, molds, trees, plants, fruits, vegetables, birds and other animals—and the many products of pyrolysis, or fire. Air, water, soil—all contain suspected carcinogens, and so does man himself. Among those reported are natural human hormones: estradiol, estrone, estriol, progesterone, and testosterone.

Perhaps the most startling to a public reared on the Garden-of-Eden theory are the natural carcinogens in our food supply and our cooking. By the mid- and the late '70s, the following had been reported to be carcinogenic based on animal tests, or mutagenic in tests on bacteria: coffee beans, tea leaves, spices (nutmeg, mace, ginger, star anise, cinnamon, and black pepper); fruits that contain the mutagen acetaldeyde (apples, grapefruits, peaches, pears, pineapples, raspberries); plant oils (cottonseed); foods with the carcinogen malonaldehyde (raisins, walnuts, peanut butter, cooked fowl, and meats); foods contaminated by natural carcinogenic molds (apple juice, apple jam, country-cured ham, wheat, barley, rye, coconut, millet, corn); some honeys; commonly eaten mushrooms; the gourmet delicacy fiddlehead fern (bracken); fresh vegetables that contain nitrates and that produce carcinogenic nitroso-compounds when combined with natural amines in such foods as cereals, fish, and

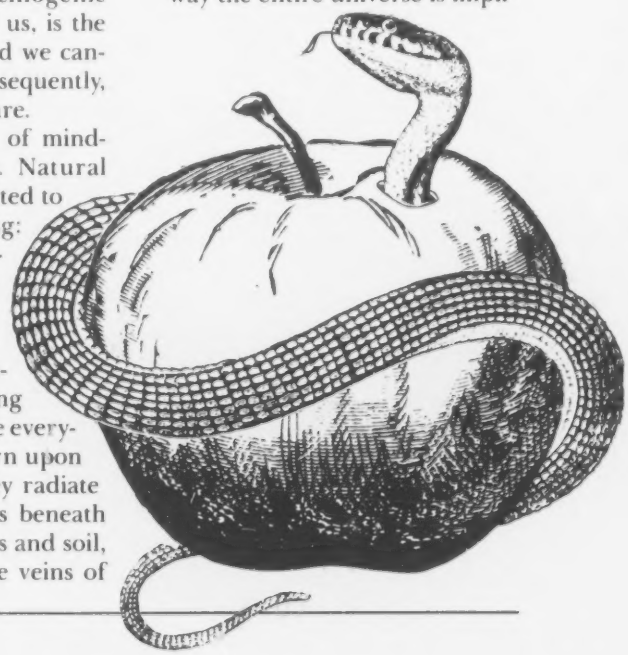
tea; and Brazil nuts, which, like all foods, contain radium, but are unusually radioactive.

All the classic food-preparation methods have been reported to be carcinogenic or mutagenic in lab tests. They include smoking, salting, fermenting, malting, broiling, and frying. When exposed to fire or high heat, the most basic elements in our diet have been found—again, in lab tests—to be mutagenic: proteins, amino acids, and sugars, including sugars in starchy foods.

These are just a few categories of the natural carcinogens and mutagens which have been reported in the literature. There are many others: Every conceivable aspect of the planet has been implicated. How valid these findings are, the layman may not be able to know, but if a significant portion of them is valid, we seem to be staring at a calamity. The calamity is theoretically assured if one accepts the government's basic premise when assessing cancer risk—the so-called no-threshold theory, which holds that there is no safe dose of a carcinogen, that even one exposure to a carcinogen, however small—even as little as one molecule—may cause cancer. Although avowedly unprovable, the no-threshold or one-molecule theory is the conceptual rock on which cancer regulation is built.

When we consider the data with the no-threshold/one-molecule theory in mind we see that we are now confronting a second carcinogenic hell. The data on chemical carcinogens produced by industry have suggested that by virtue of human action, there is nothing we can breathe, eat, or drink without encountering carcinogens. The natural data suggest that by virtue of the nature of reality itself, there is nothing we can breathe, eat, or drink without encountering carcinogens. In fact, of the two carcinogenic hells, there is something even more hellish about this one. However appalled one may be by the industrial data, one is always aware, subliminally, that there is an industrial spigot, so to speak, and that for substance after substance, the spigot could be turned off. Industrial carcinogens are susceptible to political action; one can ban products, one can close factories. Hypothetically, the whole Industrial Revolution could be turned off. But the carcinogens that have been reported here cannot be turned off. This carcinogenic hell, the scientists tell us, is the planet earth itself, and we cannot escape it. It is, consequently, a more awesome picture.

It is also a picture of mind-boggling complexity. Natural carcinogens are reported to be every kind of thing: They are animate, inanimate; chemical, physical; animal, vegetable, and mineral; they are motionless crystals, flowing gases, liquids. They are everywhere: They rain down upon us from the skies, they radiate upward from crevices beneath the sea, from the rocks and soil, they flow through the veins of plants and trees, they gush out in torrents from forests. They are alive: They grow, they crawl, they bloom, they blossom. And they are inside us: They are part of our vital physiological processes; they course through our bloodstream through our hormones; they are in our saliva, in our digestive tracts. We inhale them, we drink them, and we feed on them ceaselessly, and in the act of absorbing them, we renew the needed supply in our bodies, for we cannot live without them; we ourselves are carcinogenic and radioactive beings. And even the act of dying is carcinogenic, for putrefaction, whether of plant or of animals, breeds new carcinogens. Were we to perish on a fiery bier, our broiling tissues and the very ash to which we were reduced would be carcinogenic. If these extraordinary data are valid, they tell us that in some ungraspable way the entire universe is impli-



cated in the disease that is known as cancer.

The findings from laboratory tests on natural carcinogenic and mutagenic substances have been reported in the scientific literature. But most of these findings have not been relayed to the nation, as have the reports on suspected industrial carcinogens. This absence of information cannot be attributed to the fact that the natural carcinogens have not yet been evaluated by a stellar committee; most of the reports on industrial carcinogens that have shown up in the press for a decade have not been evaluated by stellar committees either. The International Agency for Research in Cancer (IARC) in France is the only institution that engages in systematic evaluation by high standards in the field, and its first list of "established" carcinogens appeared only in 1979–1980. What proportion of the natural data is valid, by those standards, there is no way to know.

The absence from the media of most of this information about nature does not imply that such data have been kept secret. The papers and books have been freely published and are to be found in libraries, and findings are discussed at specialized cancer conferences. They are readily available to anyone who cares to hunt for them. They might legitimately be called, however, an *institutional* secret. There is no regulatory agency in charge of investigating nature. There are no Senators seeking to enhance their careers by subjecting nature to grillings under hot television lights. There is no ardent political constituency demanding that nature's chemical innovations be arrested. There are no dramatic legal contests in which nature is the defendant. And thus, there are no Xerox machines endlessly churning out government bulletins about nature's latest toxic, carcinogenic, and mutagenic derelictions and mailing them to the press.

Nature's carcinogens and mutagens are a philosophical irrelevancy to the institutions created by the apocalyptic movement. The apocalyptic assumption that nature was almost entirely noncarcinogenic and that most human cancer had emerged from post-World War II test tubes forbade the very concept of a research agency, let alone a regulatory agency, dedicated to the study of and the dissemination of information about the carcinogenicity and mutagenicity of the earth. Just as most of the scientists are still frozen in the position determined by the history of the field, so are our institutions.

And yet, investigation of nature goes on and discoveries have been filtering through the ideological curtain. Most are still unknown, but a few have finally been discovered by the heirs of Rachel Carson. Three have been particularly shocking to them:

Vinyl chloride is the very symbol of synthetic evil, but in a paper entitled "Carcinogenic Natural Products," E. K. Weisburger of the National Cancer Institute (NCI) reported that vinyl chloride is found in tobacco. It is a natural constituent of at least one plant. If this is true, *all* Americans, who live in a society of smokers, have thus been inhaling and ingesting molecules of vinyl chloride all their lives.

Benzo(a)*pyrene* is an established animal carcinogen usually linked to the energy and automotive industries. But many scientists have reported benzo(*a*)-pyrene as a natural substance which emerges from bacteria, growing plants, and above all from pyrolysis. It is present whenever one cooks one's food, whenever one burns wood, coal, or petroleum, whenever there is a wiener roast, a backyard barbecue, a bonfire, a prairie fire, or a forest fire. Here there is not even a question: *All* Americans have definitely been inhaling, eating, and drinking molecules of benzo(*a*)pyrene all their lives.

Asbestos is an established occupational carcinogen, and in 1976, Russell Peterson, chairman of the Council of Environmental Quality, informed Congress during the hearings on the Toxic Substances Control Act: "No level of asbestos fibers in tissues is regarded as safe—a single fiber may initiate a response." But asbestos is a natural substance, its fibers can be microscopically small, and they are probably part of the natural car-

There are no dramatic legal contests in which nature is the defendant.

cinogenic "background" in which we live. In 1977, a National Academy of Sciences (NAS) committee in a document called *Drinking Water and Health*, a work frequently cited as authoritative by the Occupational Safety and Health Administration (OSHA), estimated the background amounts of asbestos in the air and water. The committee said that "natural" air (air sampled in areas remote from industrial civilization) might contain about .01 fiber per cubic centimeter, and that "natural" water might contain about 10^4 to 10^6 fibers per liter. Again, if this even approaches accuracy, *all* Americans have been inhaling, drinking, eating, and washing themselves with asbestos fibers all their lives.

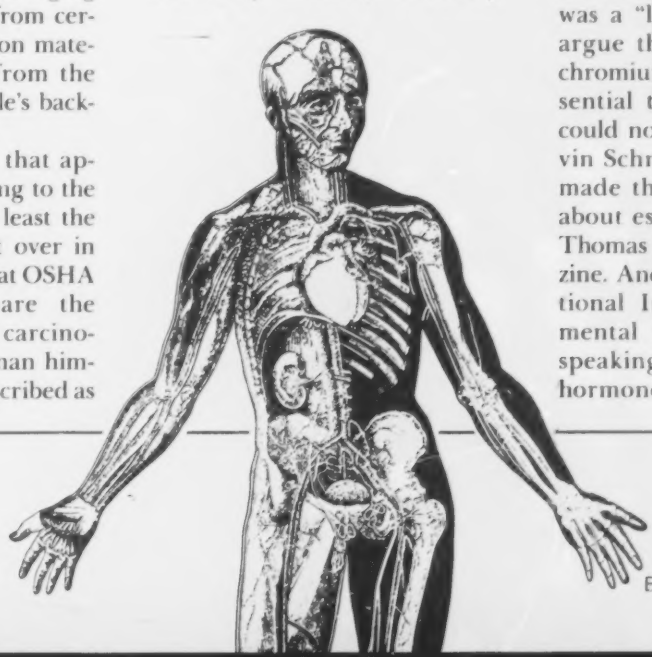
Such data obviously clash violently with the apocalyptic assumptions about nature. And, to further confuse the heirs of Carson, it was finally "discovered" in 1980—and published as news in *The New York Times*—that it was not just nuclear plants that might be leaking radioactivity into the surrounding areas, but that radioactivity was emerging from people's homes from certain natural construction materials—granite—and from the rocks and soil in people's backyard gardens.

But the discoveries that appear to be most shocking to the cancer preventers—at least the ones they have fought over in both the literature and at OSHA hearings—in 1978—are the findings on naturally carcinogenic components of man himself. Three of them, described as "established" carcinogens by the IARC, have preoccupied a great many scientists:

Nickel and chromium industries are reported to have high cancer rates—but nickel and chromium are essential nutrients for human growth.

DES, an estrogen, causes vaginal cancer in some of the daughters of the women who take the drug—but, according to IARC Monograph Vol. 6, natural estrogens and other sex hormones are carcinogens. Yet again, sex hormones are essential to human physiology.

Nitrite used to cure bacon is a chemical which, combined with the amines in industrial substances and a great range of natural foods, for example, proteins, cereals, and vegetables, produces *N*-nitroso compounds in the body—and *N*-nitroso compounds are reported to cause cancer in a *dozen-and-a-half animal species*. But, according to the IARC in 1978, 70 percent of the nitrite that enters the stomach is naturally formed in saliva; and according to Steven Tannenbaum, professor of food chemistry at MIT, "Probably thousands of times more nitrite is formed in the intestine than is contributed to the intestine from preformed nitrite in the diet." In this case, too, the human body is a natural nitrite and nitrosamine factory.



Inevitably, on learning of such findings, scientists again have taken up the lance. Within the NCI itself, Hans Falk and Herman Kraybill consider carcinogens which are required for human life to constitute major evidence that at low levels, such substances do *not* cause cancer. The NCI opposition, represented at OSHA's hearings, argued that the fact of man's need for such substances did not constitute proof that the substances were *not* carcinogenic in low doses. (As always, the theoreticians invoke or reject the fallacy of proving a negative as it suits them). Arthur Upton of the NCI stated: "I do not see that the existence of evidence for essentiality of a material as a trace nutrient is incompatible with the concept that that same material may be carcinogenic in trace amounts." Umberto Saffiotti of the NCI argued similarly that it was a "logical nonsequitur" to argue that because selenium, chromium, and nickel were essential to the body that they could not be carcinogens. Marvin Schneiderman of the NCI made the same general point about estrogenic hormones to Thomas Maugh in *Science* magazine. And David Rall of the National Institute for Environmental Health Sciences, also speaking of carcinogenic sex hormones, argued that one

. . . philosophical revisionism is now occurring in the world of regulatory science.

could not assume that there were safe or threshold doses within the body: "I know of no biochemical or physiological principle that indicates there is any reason to believe that. I find it much more comfortable scientifically to believe that they are indeed carcinogens, even at that concentration which is a biological necessity."

The nature and level of the argument was summarized by OSHA by means of a scornful joke. OSHA described the position of those who argue that chemicals required for survival cannot be carcinogenic at low doses as a "hypothesis" which "is apparently based upon an assumption that 'Nature wouldn't do it to us.'" This particular joke is genuinely funny, although not in the sense OSHA intended. The potentates of "regulatory" science would not be in their present position were it not for the hardcore apocalyptic belief that "Nature wouldn't do it to us." They rode to power on exactly that belief.

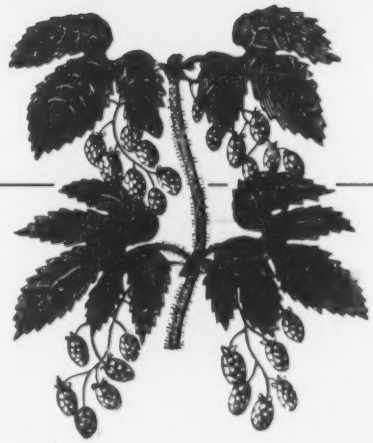
The "Nature-would-or-wouldn't-do-it-to-us" controversy is, of course, the controversy over the no-threshold theory. The quarrel over the natural carcinogens has grafted itself onto the most dramatic battle in the field. But there are two distinct audiences who are watching this drama, one in the world of chemical carcinogenesis, one in the world of radiation studies, and both have a special perspective on it. Some of the more theoretical minds in the world of chemical carcinogenesis appear to be baffled by the incessant focus on the perils of ineffably low doses, whether natural or industrial. They appear, although their dignified language camouflages it, to be asking helplessly: Where did the known danger of high doses go?

As Elizabeth Miller put it in her presidential address in 1978 to the American Association of Cancer Research: "Much data have clearly established that chemical carcinogenesis is a strongly dose-dependent phenomenon. . . . The strong dose dependence is too often slighted in public discussions of possible human hazards from mutagenic and/or carcinogenic chemicals." And Kraybill of the NCI made the same point in 1980, stating that the issue of dose dependency is never brought up in public argument over the potential threats to human beings from chemical carcinogens and mutagens.

Where *did* the high-dose danger go? It is concealed by the undemonstrable one-molecule theory itself. One cannot teach people that their greatest peril is high doses of a carcinogen while simultaneously teaching them that their greatest peril is an accumulation of submicroscopic specks of all-the-carcinogens-in-the-environment—*and* while defining the ultimate moral goal of cancer prevention as that of protecting a man who might, somewhere, sometime be struck down by a single molecule of a carcinogen to which he is peculiarly sensitive. In the process of justifying regulatory practices and training Americans to rear, like frightened horses, at the very idea of one molecule of an industrial carcinogen or mutagen, the spokesmen for "regulatory" science have expunged the strong dose dependency of carcinogenesis from the public dialogue.

The most vocal mockers in the gallery are those scientists in the field of radiation who did not learn their lesson backward, who have always known that nature *would* do it to us, that, in fact, nature *has* done it to us, and who never forget for an instant that the earth was hurled out of a nuclear explosion in the heart of the sun and that every living being is simmering in his own, and the planet's, low-level radioactivity. The laughter of a portion of this audience is so full of contempt that it has an almost savage quality. Thus: Rosalyn S. Yalow, Nobel laureate, testified to Congress in 1979: "As an adult, living human being, my body contains natural radioactivity; 0.1 microcuries of potassium-40 and 0.1 microcuries of carbon-14. According to the current rules of the Nuclear Regulatory Commission, if I were a laboratory animal who had received this amount of radioactivity as 'by-product material' and died with the radioactivity still in my body, I could not be buried, burned, or disposed of in the garbage."

To sum up, with the belated discovery that exposure to carcinogens is inescapable, both externally and internally, philosophical revisionism is now occurring in the world of regulatory science. When OSHA takes to mocking people for believing



that "Nature wouldn't do it to us," we know we are looking at a serious corrosion of the apocalyptic premises which have shaped the profession of chemical carcinogenesis, the ideology of regulatory science, and the views of the culture itself. If Rachel Carson had been able to hear the testimony of the NCI experts at the OSHA hearings testifying in chorus to nature's malignant intentions, she would have whirled furiously in her grave. There is little question that nature's carcinogenicity and mutagenicity, which has, so far, been barely-explored, is forcing regulatory scientists into a direction for which they are unprepared. The regulatory agencies are certainly not stopping to reconsider their intellectual evolution and the fact that their basic premises emerged from discoveries made in an illogical order. They are backing into the logical perspective inch by inch like a group of nervous crabs—while still clinging to the ancient belief that their mission is to chase every man-made carcinogenic "germ" on the continent. Since they are backing into it, they will soon crash into the most appalling shock of all—that, given the radioactive-carcinogenic-mutagenic dimension of the earth, and given the one-molecule theory of cancer, they must, to be consistent, chase after every carcinogenic "germ" on the planet, including those within man himself. Because they cannot see with the backs of their heads, they do not know it, but they are in a philosophical crisis.

Within the world of regulatory science itself, one hears repeated charges of epidemic irrationality in cancer experiments, of repeated publication of unsubstantiated findings, of frantic cries of wolf, of the abandonment of scientific disciplines and standards, and of the politicization of science. Although these charges frequently betray fear of a public reaction, the reason for that fear, other than that the public might be bored with or irritated by bad science, is not stated explicitly. The implication is clear that some scientists are afraid of a laymen's rebellion of some kind, but it is difficult to imagine the American public, or even a significant portion of it, identifying and rebelling against bad science, since most have no standards for good science. (One need scarcely fear such a rebellion when the National Science Foundation and the Department of Education are reporting "a current trend toward virtual scientific and technological illiteracy.")

There is one scientist, however, who has stated explicitly of what aspects of the public reaction he is afraid—and in terms that *are* applicable to laymen. He is Joseph Rodricks of the Food and Drug Administration (FDA), and he has apparently been aware for some years of a particular threat to regulatory science that will, he believes, emerge from the public.

Rodricks, precisely because he was at the FDA and was a student of the chemistry of foods, has a broader perspective on the phenomenon of carcinogenicity than do most of his colleagues in chemical carcinogenesis who are still frozen in the historical posture of the birth of the field, and whose experimental work is concentrated on synthetic chemicals. Rodricks is aware of nature's role in the problem—at least insofar as it touches on his own field, food. In 1978, in a paper entitled "Food Hazards of Natural Origin," he opened with these words:

"Let us assume for a moment that the 19th-century revolution in the science of synthetic organic chemistry never took place and that our society is not inhabited by any of those forms of technology that depend on the achievements of this science. And then let us make a second assumption, admittedly incompatible with the first, that our health scientists are blessed with up-to-the-minute knowledge of the role of chemicals in human disease and, moreover, have access to all the techniques of modern chemistry and toxicology. An environmental scientist seeking a lifelong supply of funds in such a fancied society would be well-advised to take a close look at the food consumed by its inhabitants."

He then gave his reasons for recommending a focus on food —it exposed the people continu-

ously to the most chemically complex compounds; those compounds had, on the whole, never been identified; the toxic effects of the foods, singly or together, had never been studied; and exposures to these chemicals were largely unknown. In other words, said Rodricks, there was no reason whatever for the widespread assumption that the natural food supply was "safe." He then stressed that he was not suggesting that one abandon the investigation of chemical additives—but, he said, public health would be better served if scientists acknowledged the existence of chemical risks in natural foods and sought to reduce or eliminate them. Hazard, said Rodricks, is hazard, and "whether a chemical in food is natural or synthetic, or is an intentional additive, natural constituent, or accidental contaminant is entirely irrelevant to whether it represents a human health risk." Any other view, he said, was "simplistic." Finally, he called for "priorities" in establishing such risks, whatever their source. The rest of the paper was dedicated to a discussion of several examples of naturally toxic foods and of naturally carcinogenic molds and estrogenic substances in plant foods.

In fact, Rodrick's paper had been cautious, and his documentation limited. By that date an astonishing number of carcinogens and mutagens had been reported in the food supply. The year before, Takashi Sugimura, reporting on his work with 11 collaborators, all prominent figures in Japanese cancer research, had informed a scientific audience of some of the latest findings of "mutagen-carcinogens" in foods and cooking methods. No reflection of such data had appeared in Rodricks's 1978 paper. In the same year, however, Peter Hutt, a former legal counsel for the FDA and now a member of a law firm that has represented corporate clients, was far more loquacious on the subject. In a keynote address to a conference sponsored by the International Academy of Environmental Safety, Hutt declared: "Virtually every food product on the market today contains some constituent that has been shown to be carcinogenic in at least one animal test. . . . It would be difficult to plan a diet for even one day that would be entirely free of animal carcinogens. It would surely be impossible to live for any significant time on such a diet, in light of the utter ubiquity of such substances." And Hutt reeled off a list of reported carcinogens in various foods and their components—essential vitamins and minerals, lactose, maltose, charcoal-broiled steaks, and so on. By 1979, Jane Brody of *The New York Times* was interviewing James and Elizabeth Miller, prominent basic scientists, on the subject of naturally carcinogenic foods. According to the Millers, she said, "evidence gathered thus far indicates that there may be as many naturally occurring carcinogens as there are carcinogens conjured up in industrial laboratories." James Miller cited a few of the 30 examples of which he was aware: "Every day we eat far more estrogenic substances from plant foods than we do of DES contaminants in meat." He also mentioned aflatoxin in the nitrate-rich vegetables which, when mixed with amines in other natural foods, may form carcinogenic nitrosamines in the human digestive system.

Almost none of this rapidly growing body of information about naturally carcinogenic foods, however, was being announced to the public by the FDA, which has argued that even one molecule of a synthetic carcinogen is a hazard to the public. But two of the FDA's former legal counsels, Peter Hutt and Richard Merrill, both writing with quite different perspectives for the legal profession—Merrill being substantially more sympathetic to regulation than Hutt—explained the agency's mysterious silence on the subject. Both cited the FDA's policy on natural carcinogens and naturally carcinogenic contaminants in foods which had been published in the *Federal Register* in 1979 as follows:

"Indeed, a requirement for warnings on all foods that may contain an inherent carcino-

'Studies on the relationship of diet and nutrition to cancer should be fully supported...'

genic ingredient or a carcinogenic contaminant (in contrast to a deliberately added carcinogenic substance) would apply to many, perhaps most, foods in a supermarket. Such warnings would be so numerous they would confuse the public, would not promote informed consumer decision-making, and would not advance the public health."

This statement, tucked into the middle of a long opinion on reportedly carcinogenic hair dyes, had been overlooked by all but specialists in FDA regulation. The plain but astonishing fact was that by 1979, 20 years after the passage of the famous Delaney clause which forbids the inclusion of carcinogens in foods, the FDA, as a matter of policy, was refusing to warn the American people, so as not to "confuse" them, that much if not most of their food supply was contaminated with natural carcinogens or was intrinsically carcinogenic itself. The reason, said Merrill, was obvious: "The number of carcinogenic substances that naturally occur in foods would ultimately require so many warnings as to be deafening." Thus, the agency would only warn the public of "deliberately added" carcinogens, and an enormous and growing literature of experiments reporting carcinogens and mutagens in natural foods was being officially ignored. Ironically, a 1977 paper by Sugimura and his colleagues had ended with these words:

"Studies on the relation of diet and nutrition to cancer should be fully supported academically and multidisciplinarily. These studies will provide clues to ways of preventing most of the common types of human carcinogenesis resulting from exposure to mutagen-carcinogens in normal everyday life. Finally, we must say that it really seems peculiar that the importance of mutagen-carcinogens in foods has not been the main subject throughout the long history of cancer research."

It was indeed "peculiar." Yet more peculiar was the fact that even when a veritable torrent of data on the carcinogenicity and mutagenicity of natural foods and on every process of cooking had finally emerged, the FDA's lips were apparently glued together: Government science was silent on the subject.

It was in 1980 that Joseph Rodricks, then acting associate commissioner for health affairs of the FDA, stood up one day before an audience of scientists and explained why he was worried about the public. Again, he was cautious. None of this background—and certainly no hint of a conscious FDA policy of withholding such "confusing" information—was mentioned. But in a lecture at the New York Academy of Sciences on risk assessment for carcinogens, Rodricks ended with these words:

"It seems clear to me that as we begin to apply our current methods for detecting risks to some of the myriad natural components of food, it is highly probable that we shall uncover an uncomfortably large number of chronically hazardous substances. Although this should not shock anyone who understands the chemical nature of food, it will surely come as a surprise to the public. I suspect that at least two monumental dilemmas will surface:

1. The public's skepticism about the adequacy of current methods to measure risk will rise, perhaps, to unmanageable proportions.
2. If we have high confidence in the methods we now use to measure risks from synthetic chemicals, and if on the basis of such measurements, we vigorously pursue the management of such risks, how can we justify not applying the equal vigor to the management of risks from the natural components of foods?

"I hope my projection about uncovering numerous and hitherto unrecognized risks among the natural components of food is incorrect so that we shall not

. . . the story that cancer was invented in post-World War II test tubes is false.

have to face these dilemmas. But I fear I am right."

In the same year that this projection was being made, 1980, a scientific journal published a short article entitled: "Formation of Mutagens in Cooked Foods. III. Isolation of a Potent Mutagen from Beef." The authors were numerous and were of some interest; they included Takashi Sugimura, director of the Japanese National Cancer Center Research Institute, and John H. Weisburger, former head of the Carcinogen Screening Section and former director of the Bioassay Segment of the Carcinogenesis Program at NCI. The work had been supported in part by the NCI's U.S.–Japan Cooperative Cancer Program and the U.S. Public Health Services, as well as a group of Japanese institutions. The summary was terse:

"The major mutagenic component of fried beef has been isolated using a series of chromatographic steps. The pure compound has been analyzed. . . . The results indicate that the molecular weight of this extremely mutagenic compound is 198, with an elemental composition of C_{11} H_{10} N_4. The compound is different from the known mutagenic pyrolysis products of amino acids or proteins."

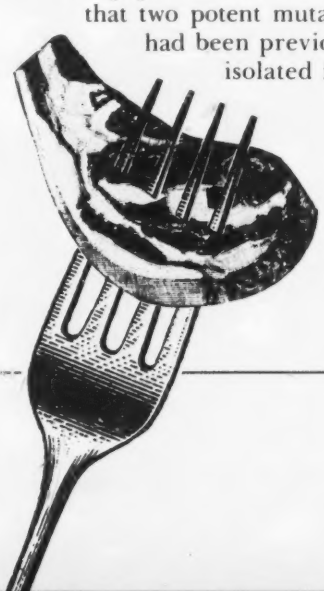
The powerful mutagen had been isolated from two sources, fried beef and beef extract—the essence of boiled beef.

Since a high proportion of carcinogens were already known to be mutagens, but it yet remained to be established that a high proportion of mutagens were carcinogens, this intensive study of mutagens in the cooking process implied that at some point, these workers in genetics were going to run those potent mutagens through animal tests to see if they were carcinogens. One could tell that both geneticists and scientists studying the relationship of nutrition to cancer were holding their breaths. It is an educated guess that Rodricks was holding *his* breath, even as he was addressing his fellow scientists.

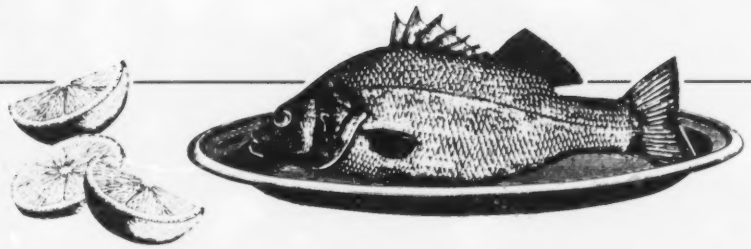
The next year, in 1981, two more papers appeared, which were part of this sequence of studies. One paper was written by a group of scientists at the Japanese cancer institute, including Takashi Sugimura. It was entitled "Structure of a Potent Mutagen Isolated from Fried Beef." And again, there was the dry, technical little summary:

"A new potent mutagen was isolated from fried beef beef. The molecular formula was determined as $C_{11}H_{11}N_5$ by exact mass measurement. The chemical structure of this mutagen was [etc. etc.]."

The paper informed readers that two potent mutagens had been previously isolated from broiled fish, and named them in chemical terms. One of those same mutagens had now been identified and isolated from "heated beef extract and fried beef, suggesting that it is present in a variety of cooked foods."



The second paper was a short article in *Science* entitled "Carcinogenicity in Mice of Mutagenic Compounds from a Tryptophan Pyrolyzate," written once again by a group of scientists from the Japanese cancer institute including the director, Sugimura, and the vice director, Takashi Kawachi. This paper reported on two mutagenic chemicals which had been found in broiled fish. One of those mutagens, said the authors, was more potent than aflatoxin B_1, which is to say that it was the most potent mutagen ever discovered. The authors reported that they had tested these chemicals in mice. At 200 parts per million, they said, they had caused liver cancers in the mice. The chemicals had not been poured into the mice in great amounts and they had not been operated on so that experimenters might implant the carcinogen directly into internal organs. The mice had simply eaten minute amounts of those chemicals in their food pellets. And, particularly important, only *one* control mouse got liver cancer. These were not ambigious findings. Although the intensely potent chemical is more mutagenic than aflatoxin B_1, said the authors, "its carcinogenicity is similar to that of 2-acetylaminofluorene"; it had matched with carcinogenicity, but less well with potency. Their conclusion



contained one short and memorable sentence:

"Thus, we report evidence of the carcinogenicity on oral administration of mutagenic compounds produced by cooking."

The first mutagens discovered in the cooking process had produced cancers.

By 1982, there were yet other discoveries. While the U.S. FDA was still refusing to inform Americans of natural carcinogens in foods, the Japanese cancer institute was reporting that 14 extremely potent mutagens —one of them the most potent known—had been identified in the cooking process itself, in broiling, frying, and boiling (at least the boiling which produces beef stock) and that six out of the seven already tested had produced liver cancers in mice.

Such data are neither more nor less significant than the data used in regulating industry. No one, including their Japanese discoverers, can say in advance what those chemicals are doing (if anything) to man, because no one can say in advance what any chemical is doing (if anything) to man. Nonetheless, as Rodricks said, the double standard is "simplistic." A chemical which produces cancers in laboratory animals is a chemical which produces cancers in laboratory animals, and if one molecule of such a chemical or one "exposure" to such a chemical must be assumed to be a cause of human cancer, then one must assume that cooking is a cause of human cancer. Unless the FDA plans to break off relations with Japan, or to hide all natural carcinogens in a vault, at some point these interesting data will become known to the public.

And they will be. One day, a critical mass of literate Americans will wake up to discover "chemical" demons dancing in their "natural" Garden of Eden. Of the demons that could most alarm a population trained to tremble at a single carcinogenic molecule, those in the natural food supply and those produced by the most common forms of cooking will be the most frightening. Food is of enormous symbolic significance in every culture; it is the crucial necessity for life known to all. A portion of the public will discount such findings as yet another cry of wolf. But those who have taken "regulatory" science most seriously will be afraid. As Rodricks predicts, they will raise questions about how cancer risk is assessed, and they will discover the unprovable one-molecule theory. And when they do, their skepticism, as Rodricks fears, *may* rise to "unmanageable proportions."

As Rodricks also predicts, questions will be raised on another issue as well, the hypocritical double standard for industry and for nature. The public will discover that the story that cancer was invented in post-World War II test tubes is false. The public will learn that it has been taught myths about the planet. The public will discover that the cancer "preventers" have been brandishing industrial perils at them while declining to inform them of the natural. The public will realize that by virtue of this selective process, it has been systematically pitted against its own economic system. The public will discover why. As political scientist Aaron Wildavsky has put it: "The richest, longest lived, best protected, most resourceful civilization, with the highest degree of insight into its own technology, is on its way to becoming the most frightened."

But the public will not be frightened forever. When a majority of literate Americans finally discovers that the country has been enmeshed for a generation in an ideological fairy tale —in a "big cancer lie"—its response will not be fear. It will, rather, be the turn of the cancer preventers to tremble. That, in fact, is why some of the most discerning are already afraid of the public. EP

'IN BALANCED COMBINATION'

Georgetown University provides a model for integrating new technologies to cut fuel consumption and meet energy needs.

By Doris Newcomb

Doris Newcomb is a Washington, D.C., writer specializing in energy issues.

In 1973, Georgetown University in Washington, D.C., faced the proverbial winter of its discontent—forced to halt classes and close its doors for a month when the energy crisis made fuel supplies temporarily unavailable. Numerous other colleges and universities across the country found themselves in a similar predicament, caught in the tight squeeze of fuel shortages and sharp increases in energy costs. Georgetown's response was unique—an ambitious energy plan to cut fuel consumption drastically and exploit new technologies to meet the university's energy needs. The results include significant savings in heating costs and in electricity consumption. Moreover, Georgetown has provided a model of initiative and ingenuity for meeting energy challenges both today and in the future.

Georgetown's original energy plan was designed to decrease oil and gas consumption, reduce overall energy use, and insure adquate energy supplies. On a larger scale, the university envisioned projects that would demonstrate how effective energy management programs, promising large-scale renewable technologies, and coal-based energy options could benefit other institutions.

The Georgetown energy program incorporates some of the most sophisticated, state-of-the-art energy technologies:

- A coal-fired atmospheric fluidized bed combustion plant can cogenerate thermal energy and electricity.
- A 300-kilowatt photovoltaic array can help shave peak electricity demand.
- Studies underway will determine the feasibility of using a fuel cell in combination with a coal gasifier to cogenerate heat and electricity.
- Even more comprehensive plans are being formulated to use emerging technologies to meet a variety of present and future needs, including transportation, between now and the year 2000.

Georgetown's program, the National Exemplar Integrated Socioenergy Systems (NEISES) master energy plan, reflects the philosophy that new energy systems are most effective when used in combination with traditional systems. Many creative energy systems developed in recent years have not proved commercially cost-effective. However, Georgetown maintains that "in balanced combination with other new or traditional energy systems, new technologies have the potential to be highly efficient and commercially feasible." By demonstrating the success of its energy system, Georgetown hopes to help speed up the commercialization and use of new technologies in general.

Energy Conservation

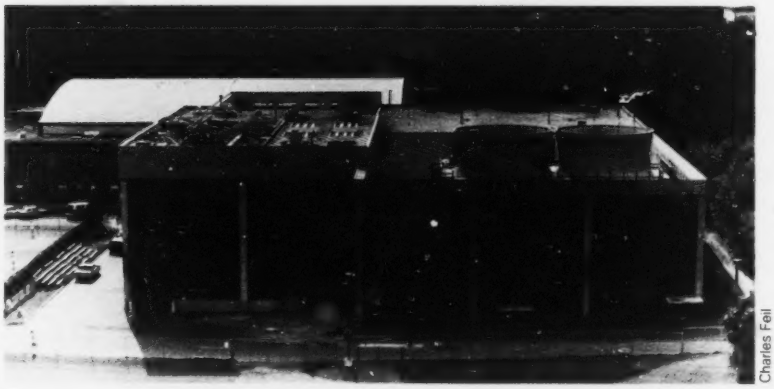
Georgetown launched its energy plan by implementing various energy conservation measures. Storm windows were installed, and fluorescent lights replaced incandescent ones. Restoration of older buildings on the 195-year-old campus emphasized improved methods for using energy, and new building designs maximized energy efficiency. For example, about 150,000 square feet of a large sports complex, completed in 1979, are underground. This solar building feature takes advantage of the relatively stable earth temperatures to reduce heating and cooling needs.

A central computer system,

Charles Feil

Georgetown's Intercultural Center with 300-kilowatt photovoltaic rooftop array.

During periods of peak demand, the computer sheds load automatically . . .



Charles Feil

Exterior of $14 million atmospheric fluidized bed combustion and boiler facility.

programmed to manage automatically the campus' heating and cooling energy load, plays a major role in energy conservation. To lower electricity consumption, the computer automatically cycles on and off electricity-consuming units such as large fans. During periods of peak demand, the computer sheds load automatically by temporarily shutting down nonessential electrical units.

The computer also regulates heating and cooling supplies in various ways. It resets supply air temperatures as low or high as possible, based on the requirements of the building area with the greatest demand. The computer also calculates precisely when heating and cooling supply systems need to begin operating during the night to produce adequate indoor temperatures by morning in offices and classrooms.

In summer, the computer controls whether air conditioning units use outdoor or indoor air for cooling. Such determinations are based on the relative heat content between outdoor and indoor temperatures and on humidity levels. Chillers serving specific buildings can be set remotely at the highest possible temperature depending on the outside temperature. In addition, the computer controls the speed of chilled water pumps at the central heating and cooling plant so that they pump only the chilled water required to meet cooling needs and maintain differential pressure.

Fluidized Bed Combustion

Georgetown began planning in 1974 for its first "national exemplar" or model facility—a $14 million atmospheric fluidized bed combustion plant. Funding assistance from the Department of Energy helped finance feasibility studies and plant construction. Located on the southwestern portion of the 100-acre campus, in proximity to two existing boilers, the plant ties into the existing steam distribution system. When constructed, this facility was the first of its kind in the United States.

The demonstration plant went into operation in 1979, and it has served successfully as the university's main steam source for heating and cooling all four million square feet of building space.

The plant operates in much the same manner as similar plants, burning coal in a fluidized bed (a mass of limestone suspended in air) to produce steam. However, it is significant to note that this plant burns high-sulfur coal in a city with strict air quality regulations. Two pollutants commonly associated with coal burning are sulfur dioxide and nitrogen oxide. In a fluidized bed combustion system, sulfur dioxide reacts with the limestone to form calcium sulfate, a solid waste easily disposed of in landfills. The coal also burns at a temperature lower than that required by the traditional coal-burning process; this decrease in temperature inhibits the formation of nitrogen oxide.

Costs have dropped substantially since the fluidized bed combustion plant began operating.

Since the plant went into operation, emissions have remained well within District of Columbia and Environmental Protection Agency standards. According to University Architect Dean Price, "this plant has demonstrated that a fluidized bed combustion system can meet a large institution's requirements economically and reliably without polluting the atmosphere."

Costs have dropped substantially since the fluidized bed combustion plant began operating. Two oil- and gas-fired boilers that previously met university needs now operate only as backup units. Because they cost roughly twice as much to operate as the new plant, savings have been dramatic.

Cogeneration

This summer, work was finished on a 2,880 kilowatt turbine generator that completes Georgetown's fluidized bed combustion plant. With the new generator the university can meet a portion of its own electricity needs through cogeneration.

The high-speed turbine generator is a "back pressure" unit, one that uses steam in sequence, first to produce electricity and then to meet thermal requirements. The amount of electricity it can produce varies depending on how much steam is needed for heating and cooling. If a full boiler output of 100,000 lb./hr. is required, the plant can generate the maximum amount of electricity. As steam production decreases, electricity generation decreases proportionally.

To produce electricity as well as steam, the plant must produce steam at a higher pressure. Before the turbine generator was added, the plant produced steam at a pressure of 275 lbs. per square inch. With the turbine generator in operation, steam is produced at 625 lbs. per square inch and passed through the turbine. The steam then leaves the turbine at 275 lbs. per square inch, the pressure required to run chiller compressors in warm weather. In winter, the steam pressure will be reduced further to the level required for the campus steam distribution system.

The turbine generator promises to be both reliable and economic. Price notes, "Since it costs very little in additional fuel to produce higher steam, the additional costs to produce electricity are small."

Electricity not needed by the university will be sold to the Potomac Electric Power Company (Pepco), whose service area includes the Georgetown campus. The university's facility is the first cogenerator of significant size on the Pepco system, which is located in a non-industrial area. The utility has worked closely with Georgetown throughout the planning process, providing technical assistance to the cogeneration planning effort, ensuring that the plant interconnection with Pepco's grid meets safety standards, and negotiating rates for purchased electricity. In all, five areas of the company have served the cogeneration project: Substations, Commercial Energy Services, Customer Engineering, Rates and Economic Analysis, and System Planning.

Pepco Senior Vice President Paul Dragoumis contacted Georgetown and offered Pepco's assistance when he first heard about the University's plan to generate electricity. He

Charles Feil

The University's 150,000 square feet sports complex takes advantage of the relatively stable earth temperatures to reduce heating and cooling needs.

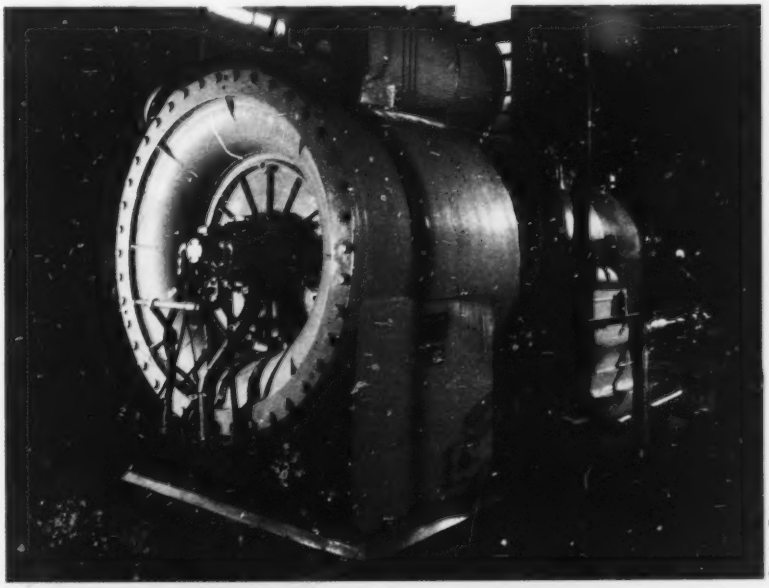
. . . this plant burns high sulfur coal in a city with strict air quality regulations.

Chiller compressor, above, and backup oil- or gas-fired boiler, below.

subsequently served on a university advisory council for three and a half years. According to Dragoumis, the cogeneration plant is consistent with the company's corporate strategy and with the aims of customers and shareholders. "Everything we're doing at Pepco is aimed at one of three strategies: maximize coal burn, avoid building new facilities as long as possible by shaping load growth, and aggressively market electricity for off-peak use." Dragoumis adds, "We'd like to see more than 100 megawatts of cogenerating facilities in our service area to help meet future demand and to defer the need for our customers to bear the cost of new facilities."

Georgetown sees further potential for utilities and other business interests to participate in cogeneration ventures through joint ownership and/or operation. The Public Utility Regulatory Practices Act requires electric utilities to purchase electricity that cogenerators choose to sell. It also allows utilities to own up to 50 percent of a cogenerator without being subject to regulation in its operation. (Rates charged consumers for electricity produced by cogeneration are regulated.)

In 1981, with a grant from the John A. Hartford Foundation, Georgetown examined potential methods for implementing ownership and operating business arrangements for the cogenerator. Among the possibilities—the cogenerator could be owned and operated jointly by the university and Pepco, owned by the university and the utility



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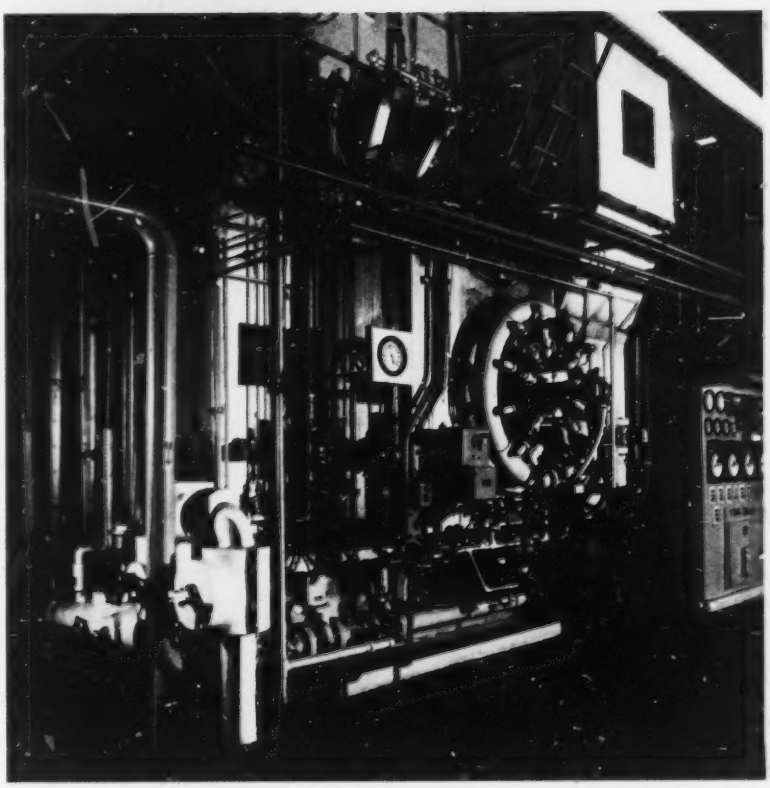

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The photovoltaic array is one of the largest in the world.

and operated by the utility, or owned by a third party and operated by the third party and the utility. Price says such arrangements would allow utilities to invest in smaller capacity units, thus deferring large additions, reducing the lead time required for expansion, and allowing utilities to achieve the most cost-effective match between supply and demand.

Reducing Peak Load

The second of Georgetown's "national exemplars" has just been completed on the university campus—a 300-kilowatt photovoltaic array on the roof of the university's Intercultural Center. The Center itself houses the School of Foreign Service, as well as numerous other university divisions, classrooms and offices, an exhibit area, and a 400-seat lecture hall. Georgetown expects the photovoltaic project to demonstrate that other large buildings could benefit from similar installations.

The photovoltaic array is one of the largest in the world, covering 36,000 square feet with 4,464 photovoltaic modules. It should meet about 40 percent of the building's peak electricity load under normal sun radiance. Construction costs for the Photovoltaic Higher Education National Exemplar Facility totalled $24 million, with $10 million provided by a federal grant and the rest by the university.

The Intercultural Center, completed in 1982, was actually designed so that photovoltaic modules could be added later. Structural elements maximize the modules' effectiveness. The building's rooftop, for example, was designed with an elevation of about 35 degrees, allowing the modules—placed at the same angle—to make maximum use of the sun's rays.

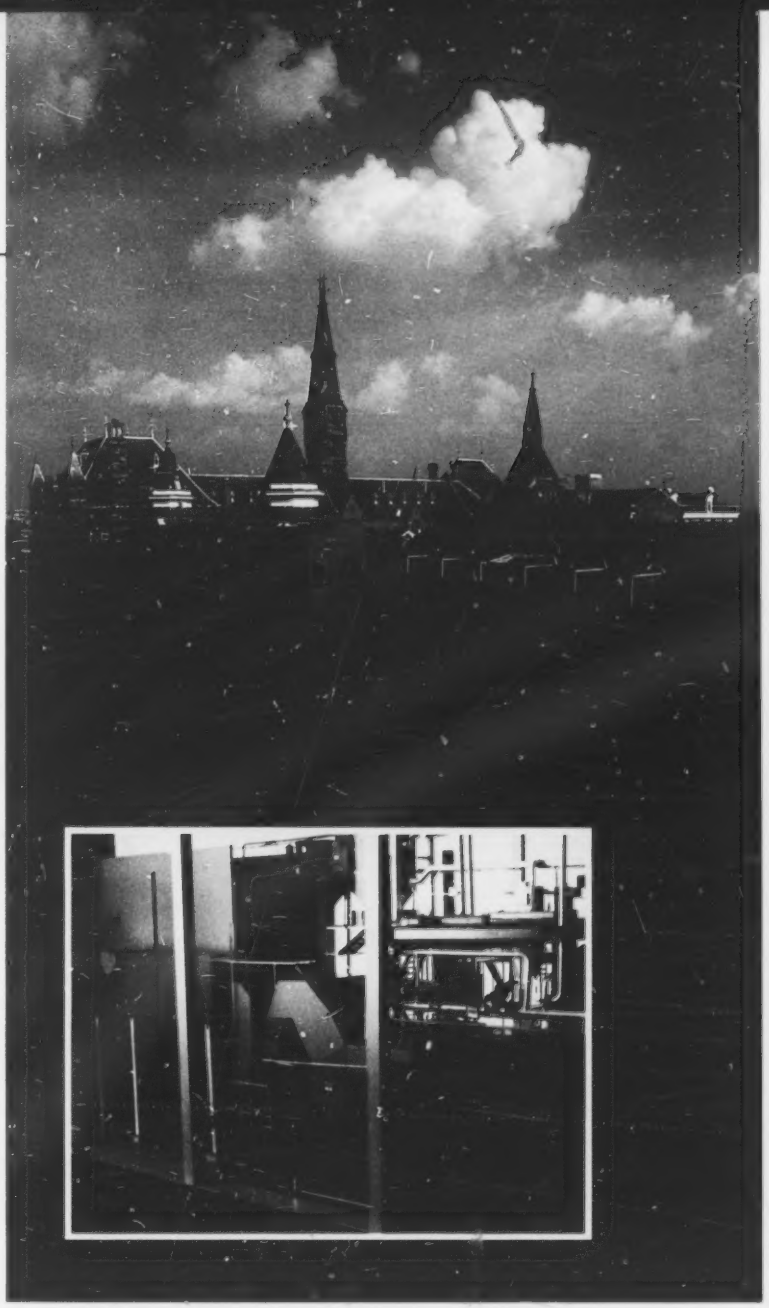
Unlike the typical rooftop photovoltaic installation, Georgetown's is an integral part of the building's structure. The flat, rectangular modules fit tightly together, forming a watertight roof for part of the building. The modules, when in place, have a varigated appearance and look like many roof surfaces; they can even be walked on. The Georgetown facility may be the only photovoltaic installation in the nation that can provide environmental protection as well as electricity, according to George Naff of Hughes Aircraft, the system installer.

The array is composed of semi- and poly-crystalline silicon cells; these cells have not yet achieved the degree of market penetration of single-crystal silicon cells. According to Naff, the poly-crystalline cells, manufactured by Solarex, are slightly less efficient than single cells, but less expensive to produce.

The photovoltaic modules use sunlight to produce direct current electricity; this electricity is converted to alternating current and sent directly into the Intercultural Center's electric power system. Although the array generally will produce less electricity than the building requires, it may produce excess electricity at times of low demand, such as weekends and holidays. Since the building's electrical system is tied into the university's system, excess electricity can go to other buildings where needed.

Most importantly, the buildings system reduces the university's need to purchase electricity during peak periods. Georgetown pays rates based on time-of-use, and these rates are highest during mid-day periods of peak demand when the photovoltaic array's output is greatest.

Georgetown has begun construction on yet another installation to reduce peak electricity demand—a two-million-gallon Cryo-Aquatic Reservoir. The reservoir system (essentially a large tank to be built underneath a 1,000-car garage on campus) employs an advanced design that cools water at night for use the following day. Between midnight and 8 a.m., when the university pays off-peak rates for electricity, electric chillers will cool the water. During daytime hours, the chilled water will circulate to provide air conditioning and then return to the reservoir for re-chilling the following night.



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Georgetown campus skyline and fluidized bed combustion plant model, inset.

Built with a $3.2 million loan from the U.S. Department of Education, the system will provide economical air conditioning for university dormitories. It is scheduled for completion by fall 1985.

Future Plans

The next phase of Georgetown's energy plan will advance a coal gasification/cogeneration/fuel-cell program. Georgetown has received an $820,000 contract from the Department of the Army and DOE to study the feasibility of using fuel cells in conjunction with coal gasifiers at the university and at three Army sites around the country. At each site, hydrogen gas produced from coal would fuel the cells, which in turn would provide heat and electricity. The university believes that such installations could produce energy efficiently and provide additional opportunities to use coal as a fuel source. Both goals are in line with national energy policies.

Planning for Georgetown's coal gasification/cogeneration/fuel-cell project began a few years ago. Examining the various alternative energy source possibilities, university planners concluded that fuel cells had a good chance of reaching the commercial market. Commercialization could be achieved more quickly, they believed, if coal were used in cogenerating fuel-cell systems.

Federal installations are formulating new energy plans based on a Congressional directive to convert their heating and cooling plants from oil and gas to coal. The Army estimated conversion costs for the first 15 sites at more than $750 million.

In its feasibility study, Georgetown will examine the possibility of installing coal gasifiers and fuel cells at Army sites in Alaska, Pennsylvania, and Texas, as well as on its own campus. Site-specific analyses will be required for all locations before commercially available coal-gasifier systems could be constructed to provide gas for fuel cells. Each fuel cell would have a capacity of 7.5 or 11 megawatts, depending on the manufacturer, and the energy system would provide hot water, steam, and electricity according to the needs of the community at the site. In some cases, excess thermal heat might be available for use in surround-

. . . Georgetown expects to tie all university energy systems together into one integrated system.

ing communities.

The federal government will review the feasibility study and examine the cost effectiveness of the projects. If it decides to proceed, the next two steps would be to conduct engineering and technical planning and then to construct the cogeneration installations. If all the plants prove economically feasible, construction costs would total $160 million in federal research demonstration funds and up to $60 million in private investment. Georgetown believes the study will prove that such plants could actually save taxpayers money. "While the federal government would provide much of the funding for the first four projects, institutional and private investors could be attracted to additional installations if the original ones prove successful," Price predicts. "Thus, such plants ultimately might be owned and operated completely by the private sector."

According to Price, future plants of this kind could supply the Army with electricity and thermal energy at a much lower cost than its gas- and oil-fired units. In the projected Georgetown scenario, the first set of installations would be financed 70 percent by the government and 30 percent by the private sector; the second set, 50 percent by government, 50 per cent privately, and the third set completely by private interests with no cost to the federal government. For several hundred additional federal installation facility conversions, federal dollars could be eliminated by third party cogenerators from the private sector.

Socioenergy Podiums

The university's master plan for development designates three areas on campus as future "socioenergy podiums." These will be large structures incorporating on various levels energy facilities, classrooms, offices, recreational and parking facilities, and residences. Price notes that, because of its location in a historic district, the university has limited space for expansion and must build structures that meet a variety of needs in one multilevel unit. "We use the term *socioenergy* because it ties all these multiple functions together," he explains.

Although socioenergy podiums are still largely in the planning stage, design and construction have begun at the first of three podium sites. The upper level of the podium would house a University Center, providing facilities for social, cultural, and extracurricular activities, as well as garden spaces and trees. Lower levels would incorporate a parking garage and new energy systems, including a giant heat pump with a multimegawatt capacity. The other two socioenergy podiums will include a variety of educational support facilities, office space, and a transportation center. As new transportation systems are developed and the need for automobile parking diminishes, parking levels in various podium structures will be eliminated, making room for additional educational and support facilities. Parking levels will be designed for easy conversion at a later date.

Energy systems in the podiums will incorporate a variety of technologies from heat pumps and thermal storage systems to coal-gasifier/fuel cell installations. Price believes the gasifiers could supply three gas streams: methane gas possibly to operate fuel-cell buses, industrial heating gas to replace oil and natural gas in auxiliary boilers, and synthetic gas for fuel cells. In turn, the fuel cells would provide additional thermal energy and electricity that could be used to meet campus and community needs. For example, electricity might be used to recharge electric battery hybrid/fuel-cell buses.

Eventually Georgetown expects to tie all university energy systems together into one integrated system, further increasing the efficient use of energy supplies. If the university system produces excess energy, the NEISES system could even be connected to the local utility grid. The District of Columbia already is considering Georgetown as a potential supplier for sectorial hot water systems.

For almost 200 years, Georgetown University has prepared students to meet the demands and challenges before them. The university's commitment to energy efficiency reflects this heritage, and its energy program provides an encouraging model of what effective energy management and a resourceful use of new technologies can mean for the future.

WHO GETS THAT DAM LICENSE?

Legislation in Congress and recent or pending judicial decisions reflect intensifying competition for the nation's hydroelectric resources.

By Peter Kelsey

Peter Kelsey is Assistant General Counsel for Edison Electric Institute. The views expressed in this article are those of the author and do not necessarily represent those of the Edison Electric Institute.

With an invaluable energy source at stake, the preference issue for hydroelectric relicensing is now a center of debate in Congress and the courts. Proposed legislation, as well as recent or pending judicial decisions concerning relicensing and other preferences, reflect intensifying competition for and questions about the allocation of hydroelectric resources to the public. For instance, for projects on federal lands, one economist suggests a bidding system for the hydroelectric resource. Because of the comparatively low cost of hydroelectric power, ultimate resolution of this debate will affect consumers throughout the country.

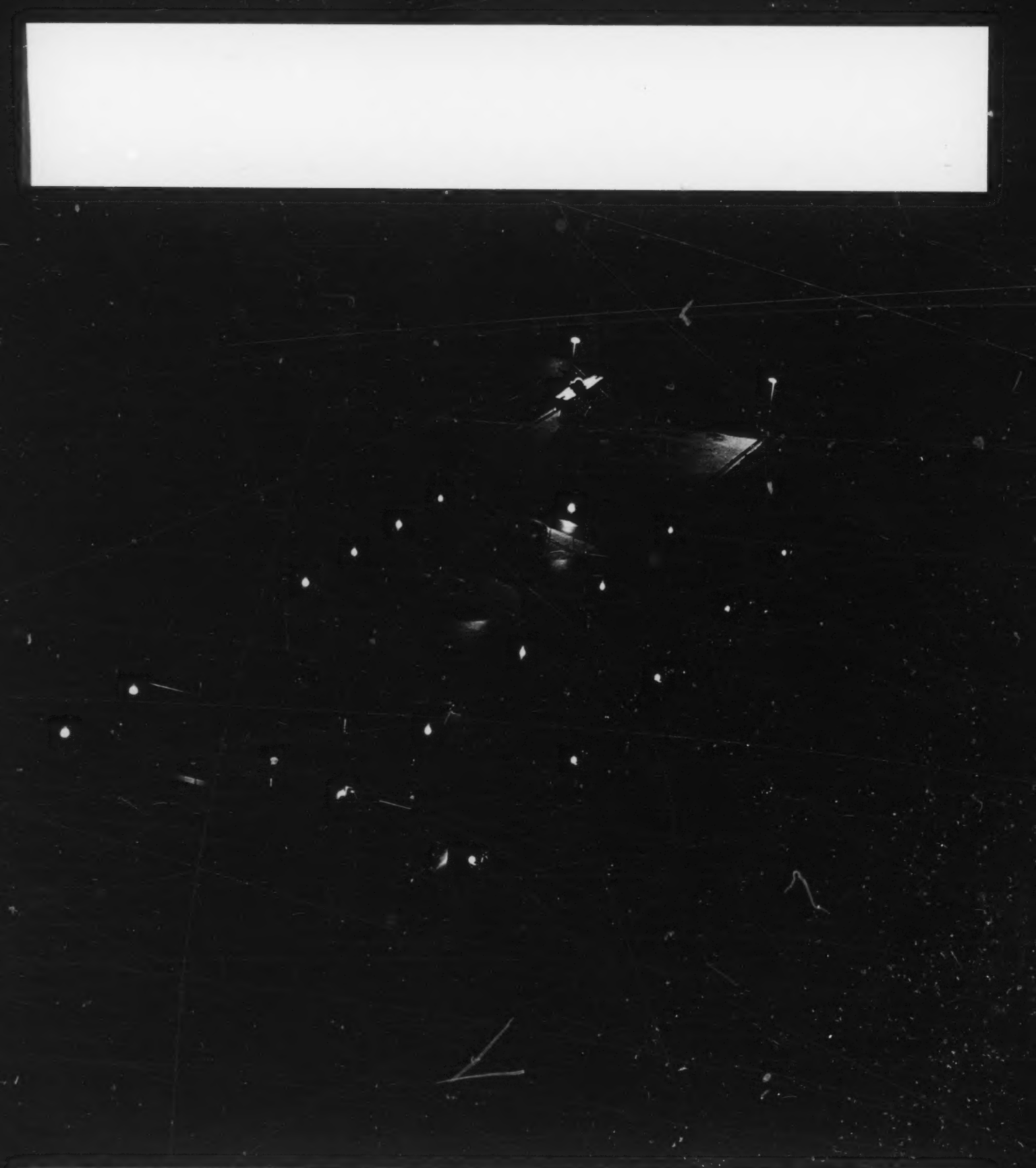
The relicensing preference controversy arose in 1980. The Federal Energy Regulatory Commission (FERC) then for the first time determined that states and municipalities can take over licenses for existing hydroelectric projects at the time of relicensing if their plans for continued operation are merely as good as, though no better than, the existing license holders'. In short, under that interpretation, state and municipal utilities would be *preferred* at the time of relicensing over an existing, non-government operator of the project. This interpretation contrasted with 1957 and 1967 interpretations by the Federal Power Commission and FERC. But in 1983, FERC reversed the 1980 interpretation in the context of the *Merwin* case, the first relicensing competition to reach the Commission for decision.

FERC based its conflicting decisions on interpretations of the 1920 Federal Water Power Act, which became the Federal Power Act (FPA) in 1935. All agree that this legislation granted states and municipalities a preference over private utilities in obtaining the initial license to own and operate hydroelectric plants. When the legislation was enacted in 1920, electricity could be transmitted only over short distances, and Congress wanted to be sure that municipalities would not be precluded from access to hydroelectricity for municipal uses such as street lighting and streetcars. But at that time no one envisioned the dramatic changes in technology, fuel costs, and electric utility regulation that have shaped electricity demand and energy costs in recent decades and prompted questions concerning the merits of a preference policy today.

Congress recessed this past August having reached no resolution to the hydroelectric relicensing dispute—an issue of major importance to investor-owned utilities. And it is unlikely that Congress will resolve the issue in the balance of this session. However, issues that arose this year, particularly in the context of the Shelby (H.R. 4402) and Ottinger (H.R. 5299) bills, undoubtedly will resurface during debate on hydroelectric relicensing during the 99th Congress in 1985. An analysis of this legislation reveals a great deal about the preference controversy and what may be necessary to resolve it.

H.R. 4402 The Shelby Bill

Introduced by Representative Richard C. Shelby (D-AL) and 44 original co-sponsors in November 1983, the Electric Consumers Protection Act (H.R. 4402) does not affect the preference for preliminary permits and original licenses, but it does make clear that a municipal preference does not apply at re-



Ultimate resolution of the hydro debate will affect consumers throughout the country.

The current compensation standard covers only net investment plus severance damages . . .

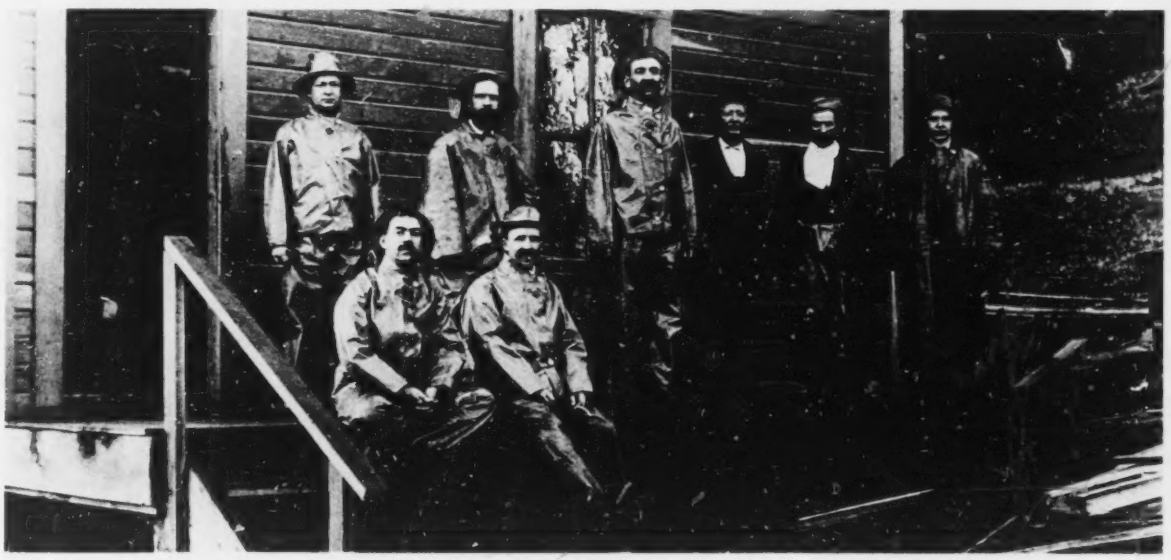
licensing. The bill explicitly identifies Section 10(a) of the FPA as the basic standard for judging the merits of competing applications for a new license at the time of relicensing. According to this standard, under the Shelby bill the existing licensee's application would have to be "best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, for the improvement and utilization of water-power development, and for other beneficial public uses, including recreational purposes." If the application did not meet this test, the existing licensee would not receive a new license.

The Shelby bill also would change the current law regarding compensation for the existing licensee should a new license be issued to another applicant. The current compensation standard covers only net investment plus severance damages—with net investment interpreted to mean only the original cost of the plant 50 to 60 years ago depreciated over the life of the license. Just one example amply justifies the concern of the utilities and their customers that they will not receive adequate compensation for their hydroelectric projects if they are lost to municipal applicants. The administrative law judge in his initial decision in the *Merwin* case found that Pacific Power & Light Company (PP&L) had a net investment in the 136 megawatt project of only $9.4 million as of June 1982. Moreover, the judge found that the utility was due no severance damages. FERC staff, however, contended that future power costs from a replacement thermal plant would be $732 million.

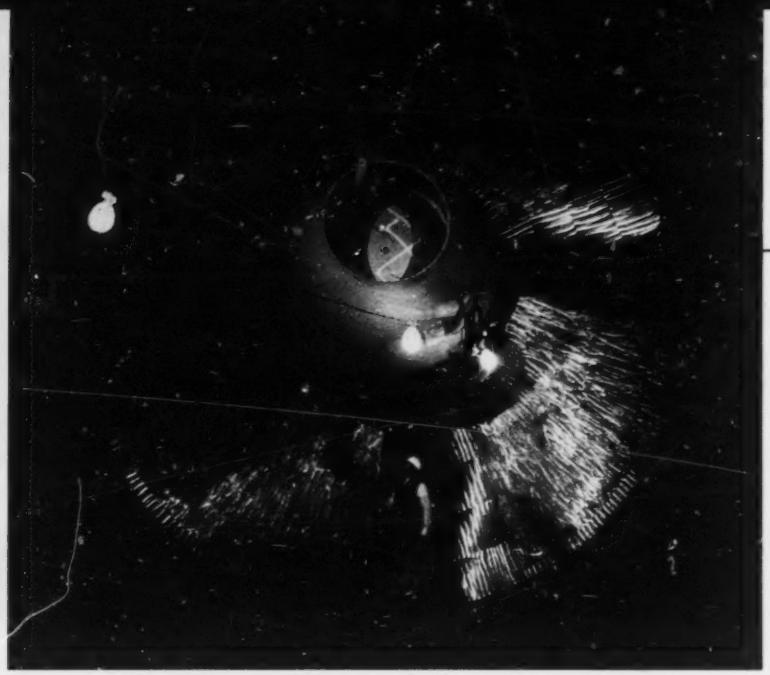
The Shelby bill would require the new licensee to pay "just compensation as determined by FERC in accordance with due process of law." Under this new value-related standard, the original licensee and its customers could hope to receive fair compensation for the value of the facility and the power it produces. For example, the new compensation standard could take into consideration replacement energy and capacity costs.

Since its introduction, the Shelby bill has attracted 118 cosponsors from across the country. They reflect the bill's broad political and ideological support throughout Congress: from Chip Pashayan (R-CA) to Henry Waxman (D-CA), Howard Neilson (R-UT) to Bob Carr (D-MI), and Trent Lott (R-MS) to Tony Coelho (D-CA). Recently, Claude Pepper (D-FL), persuasive advocate for elderly Americans, has joined as a cosponsor.

The investor-owned utility industry is one among a number



No one envisioned the dramatic changes in transmission technology, fuel costs, and electric utility regulation since the days of this early hydro crew.



A municipal preference should not be used to take away existing projects at the time of re-licensing.

of varied interest-groups who support the Shelby bill. Others include:

American Association of Retired Persons (AARP)
American Farm Bureau Federation
National Association of Regulatory Utility Commissioners (NARUC)
Commissions:
- California Public Utilities Commission
- State of Colorado—Public Utilities Commission
- State of Michigan—Public Service Commission
- State of Washington—Utilities and Transportation Commission

Building and Construction Trades Department
International Brotherhood of Electrical Workers (IBEW)
Utility Workers Union of America
Teamsters Local 572
Business Roundtable
U.S. Chamber of Commerce
Electricity Consumers Resource Council
American Petroleum Institute
National Association of Counties
National Association of Manufacturers
American Paper Institute
National Conference of State Legislatures
Mayor, Salt Lake City, Utah
Mayor, Charlotte, North Carolina
California State Grange
Association of California Water Agencies
County Supervisors Association of California
Mayor Pro Tem, Clovis, California

A large number of newspapers have also endorsed Shelby's bill, including editorials in the *New York Times*, the *Sacramento Bee*, the *Pomona Progress Bulletin*, and the *Kansas City Star*.

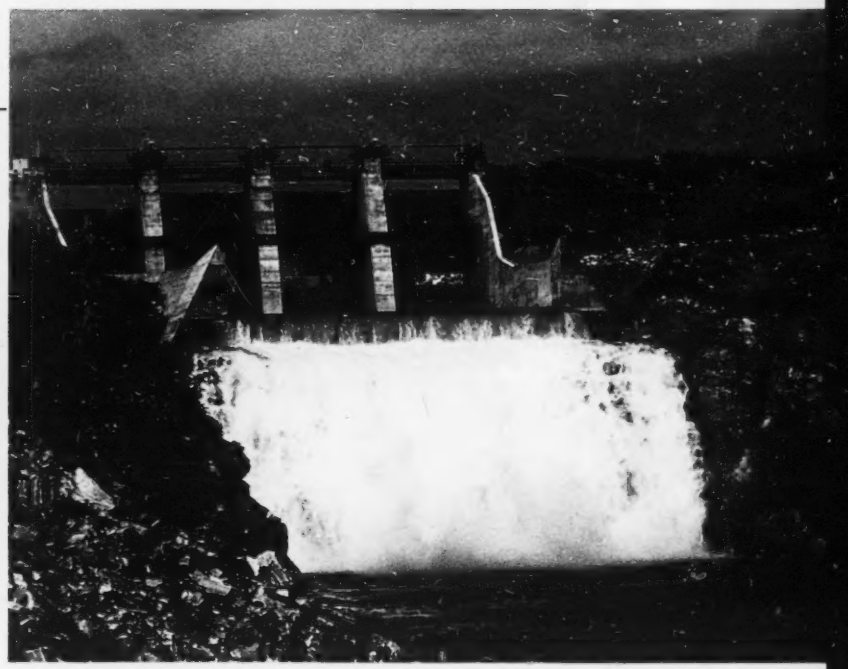
A basic issue of fairness has convinced these and other parties that a municipal preference should not be used to take away existing projects at the time of relicensing. Many are asking how public policy can use the ownership status of a competing municipal utility to justify taking away a fuel-free hydroelectric project from millions of customers who have paid for it through their rates over the years.

Of course, public power advocates for a municipal preference at relicensing have received some support for their position as well. The main source of that support has come from the Consumer Energy Council of America, an organization chaired by Alex Radin, Executive Director of the American Public Power Association.

H.R. 5299 The Ottinger Bill

Representative Richard Ottinger (D-NY) has been chairman of the Subcommittee on Energy Conservation and Power of the House Committee on Energy and Commerce during the 98th Congress. He characterizes a bill he introduced as reaffirming that a preference for public agencies does exist. Although acknowledging that under his bill preference is largely symbolic, he believes it offers some encouragement for public power entities to compete for hydroelectric projects, knowing that they need have a plan only as good as that of an existing licensee. According to Ottinger, the Shelby bill discourages competition by creating a rebuttal presumption in favor of an existing licensee—i.e., the Commission would have to find that the original licensee's plan did not satisfy some of the section 10(a) criteria before issuing a license to another applicant.

The Ottinger bill, rather than relying on the existing 10(a) standard, would establish a more general standard for the issuance of a new license. The li-



The license would go to the applicant whose plans are "best adapted to serve the public interest."

cense would go to the applicant whose plans are "best adapted to serve the public interests." However, the Ottinger bill enumerates three specific factors for FERC to consider in applying this standard.

The first factor concerns environmental impacts related to hydroelectric plants, including familiar environmental concerns about protecting water resources and mitigating impacts to aquatic systems. However, the proposal goes a step further and includes an obligation to "enhance" the environmental values of a water resource, without calling for a balancing of enhancement with costs, power production, or other related considerations. With such environmental language, Ottinger attracted the support of environmental organizations. In fact, environmental organizations assisted in drafting the proposal. However, the proposal in effect would do little more than reflect requirements already in FERC regulations. But it would place a seemingly unrestricted statutory burden on the existing or new licensee to improve the environmental values present in the project area at the time of relicensing. And the environmental emphasis would underscore FERC's National Environmental Policy Act responsibilities. (See the Regulatory Review column in this issue of *Electric Perspectives* for a related discussion resulting from the Ninth Circuit Court's decision in the *Yakima* case.)

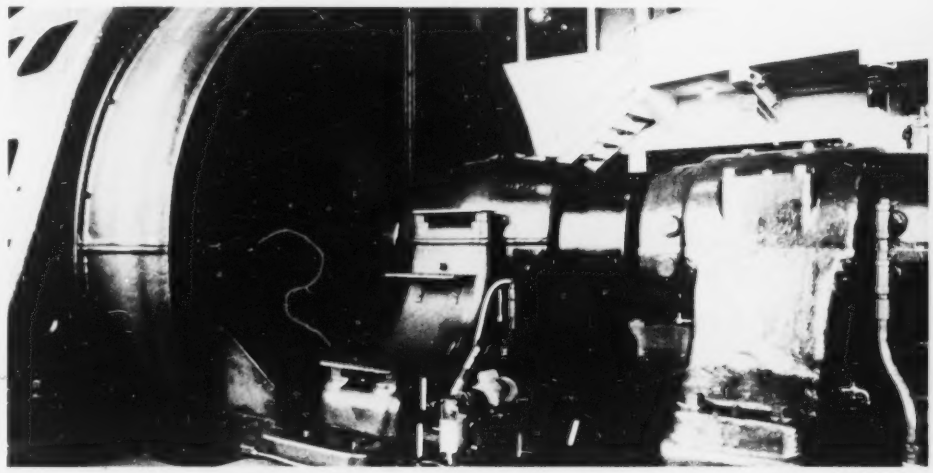
The second criterion in Ottinger's bill would direct FERC to consider economic impacts of issuing a license to each applicant. For electric utilities, such impacts include the effects on ratepayers if a utility were not to receive the new license. This section of the bill would make explicit the criterion applied by FERC in the *Merwin* decision, the authority for which is currently being challenged by the municipal applicants in court. As defined by the Ottinger bill, economic impacts would also include "the impact on economic efficiency." Economic efficiency arguments are an important aspect of the relicensing preference controversy. For some utilities, the hydro component would reduce electric rates below marginal cost far less than for others whose electric rates would be based entirely or largely on hydroelectricity, as is the case for many municipal utilities. The large discrepancy between true marginal cost of electricity and the electric rates charged by a municipality would be economically inefficient, could promote wasteful use of energy, and create essentially artificial demand for construction of new generation sources. (See Jaskow and Schmalensee, "Economic Efficiency Criteria For Evaluating Adversary Hydro Relicensing Applications," National Economic Research Associates, Inc., July 1984.)

The third criterion in the Ot-

tinger bill, electric consumption efficiency programs contains no guidance to the Commission in terms of comparing the relative performance or plans of competing applicants. Whether this criterion would be advantageous to existing investor-owned licensees would require a case-by-case comparison between the conservation programs of the existing licensee and municipal competitors. But utility conservation programs are run at the state level. Ottinger's proposal would constitute significant federal intrusion into those programs, and where some state commissions have not been receptive to such programs, the proposal could be a significant handicap for the regulated investor-owned utility in contrast to an unregulated municipal utility.

The Ottinger bill retains the net investment standard as the floor for compensation to an existing licensee if a license is awarded to another applicant. However, if the original license holder were an electric utility, a competitor could stipulate to pay compensation in excess of the net investment. The Commission would consider this additional compensation in determining the economic impact on the ratepayers of the existing licensee and the successful applicant for a new license.

The Ottinger bill gives competing municipalities a distinct advantage, in addition to the preference, when competing for an investor-owned utilities project. If the compensation the municipal utility paid was less than just compensation, it could easily afford deluxe fish and wildlife enhancement measures and conservation plans in its application that might not be justifiable on a cost-benefit basis. Regulated investor-owned licensees, on the other hand, would have to be more conscious of the cost and benefit comparisons in what they propose.

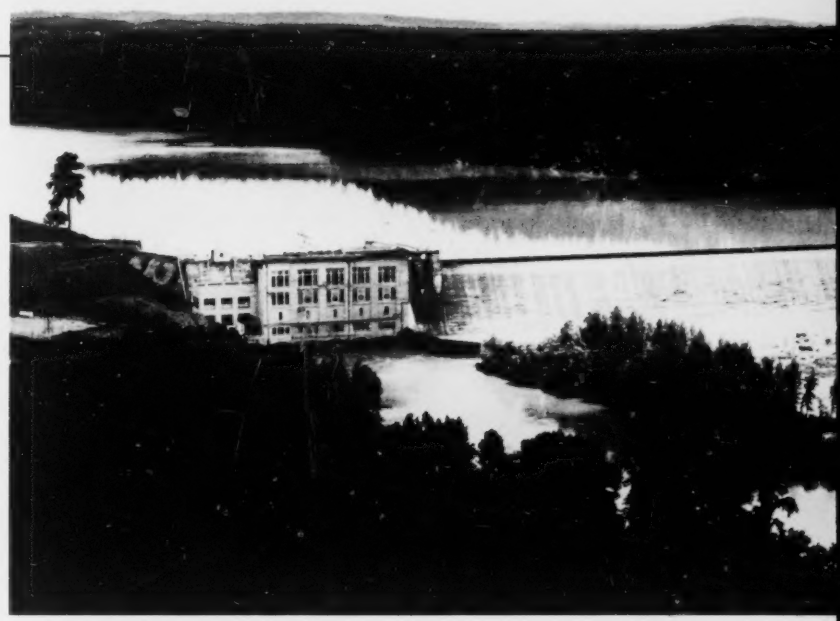


The Ottinger bill gives competing municipalities a distinct advantage.

Other Legislation

Proposed legislation introduced by Representative Albert Gore (D-TN) states that preference under the FPA as it applies in initial licensing should be extended to include electric cooperatives. And he interprets the present law to say the same preference applies at relicensing. Though this bill (H.R. 5416) received little attention this year, it is unique in calling for an elaborate antitrust review as a condition for relicensing. Lifted directly from the Atomic Energy Act where it applies to nuclear plant licensing, in the context of hydro relicensing the protracted antitrust review procedures were out of place. Whether or not this approach will resurface again in the 99th Congress is problematic.

Prompted by the interest and support in the House for making clear that municipal preference does not apply at relicensing, two senators introduced legislation to that effect. Senator Malcolm Wallop (R-WY) and nine other senators introduced S. 2710, a companion bill to H.R. 4402 (the Shelby bill). Senators Bradley (D-NJ), Proxmire (D-WI), and Murkowski (R-AK) subsequently have become cosponsors. Senator J. Bennett Johnston (D-LA) introduced S. 2711—a bill that would create a rebuttable presumption in favor of the existing licensee. Under the Johnston bill, the existing licensee would receive the new license unless the Commission determined that another applicant had a plan *better* adapted to serve the public interest. In contrast to the Shelby and Wallop bills, Senator Johnston did not address



compensation in his bill but he indicated he had an open mind on the subject.

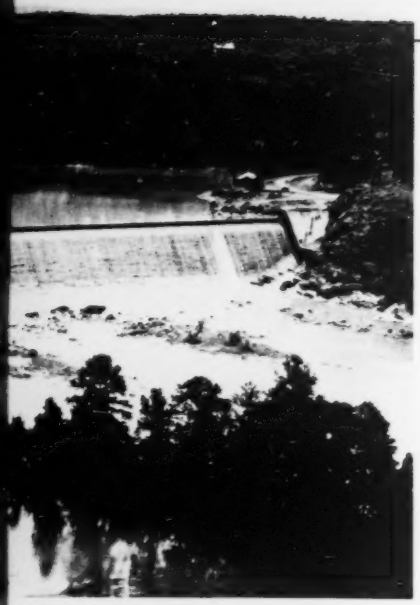
House Hearings

With the public's interest aroused and broad support arising in the House for H.R. 4402, Ottinger agreed to a hearing on the three House bills which was held on May 17, 1984. Representatives Shelby, Charles Pashayan, Jr. (R-CA), Tom Bevill (D-AL), Victor H. Fazio, Jr. (D-CA), and Anthony Coelho (D-CA) presented testimony in support of H.R. 4402. For the administration, Assistant Secretary Jan Mares of the Department of Energy and Commissioner A. G. Sousa from FERC advocated its enactment. In addition to these and the panel of investor-owned electric utility company witnesses, eight other witnesses testified in support of the Shelby bill. A comprehensive statement containing arguments and data was filed on behalf of the investor-owned electric utility industry by the Edison Electric Institute.

Given a subcommittee setting that typically has been a difficult one for private utilities, most observers opposing preference at relicensing felt their position had been presented persuasively at the hearings. Nonetheless, Chairman Ottinger made his position clear: a bill would not emerge from his Subcommittee unless an accommodation could be reached between his position, as reflected in H.R. 5299, and that of Representative Shelby. Following the hearings, the question became: could it be done with one side intent upon making clear that no preference applied at the time of relicensing while the other side insisted on a preference.

Negotiations during June and July failed to result in an accommodation between the two sides. Whether or not preference should apply at relicensing and the level of compensation to be paid by a successful competitor proved insurmountable issues. With Ottinger's retirement this year, it is unclear what other major issues will arise in the 99th Congress, but these two will clearly be among the prominent ones. It is likely also that any bill that emerges from the Energy and Commerce Committee will contain specific fish and wildlife protection provisions.

Although most of the action and publicity so far this year has focused on congressional deliberations, the relicensing preference issue also is pending before the United States Court of Appeals for the District of Columbia in the so-called *Merwin* case, *Clark-Cowlitz Joint Operating Agency v. FERC*. That case challenges FERC's award of a new license for the Merwin project to the existing licensee, Pacific Power & Light (PP&L), after a comparison on the merits with the competing municipal applicant. FERC's decision overturning its 1980 Bountiful opinion, by ruling that a municipal preference did not apply against an existing licensee at the time of relicensing, is also being challenged. The case was filed following FERC's issuance of Opinion 191 in October, 1983, has been briefed by all parties including intervenor Edison Electric Institute, and is scheduled for oral argument on October 18, 1984. The court could issue a decision before the end of the year, though whatever the outcome, the losing side probably will seek a Supreme Court review.



Other Preference-Related Developments

In May, Representative Barbara Boxer (D-CA) introduced a surprising amendment on the House floor, calling for power from Hoover Dam to be auctioned off to the highest bidder. The so-called "Boxer Rebellion" was significant both in its intent and because it received a surprising amount of support with little foundation having been laid. The proposal was defeated by only 20 votes.

Boxer's proposal focused attention on whether the low price of federally marketed hydro power, enjoyed mainly by municipal and cooperative utilities, is sound public policy. Municipal and cooperative utilities have a preference in purchasing power from Hoover Dam. Similar "marketing preferences" are found in many other federal laws. Preferential access to the low-cost, fuel-free hydro power, priced far below the marginal cost of electricity, has tremendous value, and a strengthening coalition of environmentalists and taxpayers oppose what they suggest is an economic anachronism. Environmentalists argue that such cheaply sold power stimulates wasteful energy use. Rather than conserving energy, it will increase demand for additional generating capacity. Taxpayers organizations also oppose the present policy, arguing that taxpayers are involuntarily subsidizing the sale of low-cost power from federal projects to small, select segments of the public who, by geographic happenstance, are customers of municipal or cooperative electric utilities.

Power marketing preferences have been the subject of attention in other forums as well. At the administrative level, on April 15, 1983, Utah Power & Light (UP&L) filed a response to the Western Area Power Administration's (WAPA) notice of proposed marketing criteria for a post-1989 marketing plan for hydroelectric power generated by the Colorado River Storage Project. The utility argues that its customers who reside in cities that would qualify as preference entities are as entitled to benefit from low-cost preference power from the Storage Project as are those consumers who by happenstance are served directly by municipal utilities. UP&L proposes that its residential customers either have an equal right to receive the benefits of the Project's preference power, or the preference provisions as interpreted by the Power Administration are unconstitutional.

On September 4, 1984, WAPA issued revised proposed marketing criteria. The revised criteria deny UP&L's request and that of the 143 cities, counties, and towns that applied through UP&L. WAPA has called for additional public comments on the revision. Whether UP&L will ultimately succeed in establishing this important precedent is unknown. If pursued all the way to the U.S. Supreme Court, the answer will not likely come until the latter part of the 1980s at the earliest.

The Supreme Court and U.S. Court of Appeals have turned back municipal preference related cases.

In cases arising on the west and east coasts, the Supreme Court and the U.S. Court of Appeals for the Second Circuit, respectively, have turned back municipal preference-related claims to hydroelectric power generated at federal and state hydroelectric projects. In *Aluminum Company of America v. Central Lincoln People's Utility District*, 104 S.Ct. 2472 (1984), the Supreme Court upheld the Bonneville Power Administrator's allocation of hydroelectric power in excess of firm power needs to industrial customers served directly by the Bonneville project. These allocations were challenged by preference utilities who argued, among other things, that the new contracts entered into with the industrial customers, under terms of the Pacific Power Northwest Electric Power Planning and Conservation Act of 1980, negated the preference accorded the public utilities under prior (1975) contracts and violated section 5(a) of the new law requiring power

sales to be subject to a preference. The Court found that the preference provisions in the Bonneville Project Act of 1937, as incorporated into the Regional Act, did not apply to the initial contracts that the Regional Act required the Bonneville Power Administrator to offer to direct-service industrial customers.

In *Power Authority of the State of New York v. FERC* (2nd Circuit, August 15, 1984), the U.S. Court of Appeals for the Second Circuit afirmed a FERC order preserving through 1985 contracts between the New York Power Authority (PASNY) and private utilities against claims raised by municipal utilities. Under the Niagara Redevelopment Act, preference to half of the Niagara Project's power must go to public bodies and non-profit cooperatives, up to the level required to fill their "reasonably foreseeable needs." By 1978, when the municipalities wanted more power from the Niagara Project than had been allocated to them in 1960-61, PASNY said none was available from the Niagara Project. FERC would not order modification of private utility contracts allocating power earlier determined to be in excess of the preference utilities' needs, largely because the Power Authority had been able to make up the shortfall using other equally priced hydropower. The court ruled, however, that in the 1985-1989 period, if the Power Authority was unable to meet the preference customers' needs, existing contracts with private utilities could be modified to make more power available to the municipalities.

Conclusion

Although arising in different contexts and forums, all these preference-related controversies reveal a common motivation: private entities want to hold onto the relatively small portion of the valuable source of low-cost power they now have, while preference entities want to gain an even greater share of this resource. The preference principle, whether in the licensing of hydroelectric projects or in the marketing of power from federal and state projects, originated when the costs of electricity generated by hydro plants was aligned more closely to the costs of electricity generated from other sources. A comparison of production costs for 1970 and 1980 is enough to show that this is no longer the case, however. In 1970 the production costs for hydroelectricity (operation, maintenance, and fuel) were .56 mills per kilowatt-hour (kWh); those for steam-electric plants were 3.98 mills. By 1980 the comparable costs for steam-electric plants were more than 15 times those for hydroelectricity—23.54 mills compared to 1.52 mills.

What the court of appeals said in the context of the *Niagara* case is equally applicable in other preference contexts addressed in this article: "[W]hat no one foresaw (or could foresee) . . . was that the 1973 oil embargo, which drastically increased the price of fossil fuels, followed by double-digit inflation would suddenly make hydro power a prized commodity." In its filing with the Western Area Power Administration, UP&L pointed out that in 1981-82 Colorado River Storage Project power was marketed for less than 8 mills per kWh. Thermal-based power was costing in excess of 50 mills per kWh, and UP&L projected new thermal-based power as costing in excess of 70 mills per kWh. It should be no wonder, therefore, that the interest in and competition for hydroelectric power resources has intensified.

In the context of hydroelectric relicensing, Congress and the courts are facing a generic question: When a resource has become as comparatively valuable as hydroelectric power, should federal laws contain a preference that would concentrate hydroelectricity among the relatively few electric consumers who, by geographic happenstance, are served by a government run utility, or should the benefits be spread as broadly as possible to millions of consumers through authorized mechanisms to ensure fair and equitable competition for or access to this resource? The answer is crucial—not only to the investor-owned utilities, but even more so to the millions of customers whom they serve.

REVIEWS

FINANCIAL REVIEW

EARNINGS PER SHARE INCREASE 23 PERCENT; TOTAL ASSETS HIT RECORD $353 BILLION, UP 10 PERCENT

The average share of electric utility common stock outstanding during the first quarter of 1984 earned $0.91 off of an 11.3 percent increase in kilowatt hour sales. This figure represents a 23.0 percent increase over earnings of $0.74 in the first quarter of 1983. Electric operating revenues increased 12.5 percent, while total electric operating expenses increased 11.1 percent, resulting in an 18.9 percent increase in electric operating income. Combined income from other utility and non-utility operations increased 38.7 percent, and allowance for funds used during construction (AFUDC) was 8.2 percent higher.

Electric utility operating revenues were $28.6 billion in the first quarter of 1984, 12.5 percent greater than the first quarter of 1983. Driving the revenue growth was an 11.3 percent increase in kilowatt hour sales to ultimate customers. This increase resulted primarily from continued economic improvement and weather which was, on the average, colder than the first quarter of 1983.

Operating Expenses

Electric operating expenses totalled $23.2 billion during the first three months of 1984, up 11.1 percent from the same period in 1983. Total operation and maintenance expenses (including fuel) increased 7.5 percent. While recording its greatest relative increase since the fourth quarter of 1981, fuel expense represented only 38.6 percent of total electric operating expenses, the lowest level since Edison Electric Institute (EEI) began tracking the figure on a quarterly basis in 1976. Total income tax expenses increased 39.2 percent during the first quarter of 1984 and 37.2 percent for the twelve months ending March 31, 1984, indicating an improved profitability of many companies in the industry. One year ago, during the first quarter of 1983, total income tax expenses increased only 6.7 percent.

During 1983, the provision for deferred taxes increased an estimated 184 percent over 1982. An EEI study of this increase determined that deferred income taxes arising from nuclear fuel disposal or storage costs, deferred fuel or energy costs, and the reversal of certain regulatory balancing accounts each created a greater increase in deferred income taxes for the industry as a whole than accelerated or liberalized deductions for depreciation.

Income from other utility and non-utility operations contributed $1.3 billion or $0.26 per share (about 29 percent) to earnings in the first quarter of 1984. This is an increase from $1.0 billion or $0.20 (27 percent) per share in the first quarter of 1983.

The impact of declining construction expenditures and plant cancellations have become evident in the decreasing rates of increase in total AFUDC and construction work in progress (CWIP). The rate of increase in total AFUDC continued to decline in the first quarter of 1984, increasing only 8.2 percent compared to a 19.4 percent increase in the first quarter of 1983. For the twelve months ending March 31, 1984, AFUDC increased 13.5 percent over the twelve months ending March 31, 1983, the lowest increase since the twelve months ending September 30, 1981. Over the same period, accumulated CWIP increased only 7.1 percent, to $101 billion.

Increased revenues, resulting in major part from higher sales of electricity and declining rates of increase in AFUDC, have improved the quality of the industry's earnings. In the first quarter of 1984, AFUDC accounted for 45.3 percent of income available for common stock, down from 54.6 percent one year earlier. For the twelve months ending March 31, 1984, AFUDC made up 52.4 percent of earnings, compared to 58.7 percent one year earlier.

Table 1

Investor-Owned Electric Utility Industry Statement of Income
For periods ending March 31, 1984 and 1983 (unaudited) (Millions of Dollars)

	Quarter Ending March 31,			Year Ending March 31,		
	1984	1983	% Change	1984	1983	% Change
Total Electric Operating Revenues	$28,618	$25,446	12.5	$111,572	$101,495	9.9
Electric Operating Expenses						
Fuel	$8,940	$8,476	5.5	$36,152	$35,350	2.3
Other Operation & Maintenance	7,092	6,434	10.2	27,256	25,250	7.9
Depreciation & Amortization	2,206	2,018	9.3	8,417	7,669	9.8
Taxes Other Than Income Taxes	2,137	1,926	11.0	8,032	7,272	10.5
Income Taxes (Federal & Other)	1,019	713	42.9	3,614	3,168	14.1
Provision for Deferred Income Taxes	1,016	619	64.1	4,898	2,268	116.0
Investment Tax Credit Adjustment, Net	751	670	12.1	1,923	2,169	(11.3)
Total Electric Operating Expenses	$23,161	$20,856	11.1	$90,292	$83,146	8.6
Electric Operating Income	$5,457	$4,590	18.9	$21,280	$18,349	16.0
Other Utility Operating Income	733	548	33.8	1,394	1,025	36.0
Total Utility Operating Income	$6,190	$5,138	20.5	$22,674	$19,374	17.0
Other Income	590	406	45.3	1,875	1,490	25.8
Allowance for Other Funds Used During Construction	1,274	1,168	9.1	5,138	4,308	19.3
Total Income Before Interest Charges	$8,054	$6,712	20.0	$29,687	$25,172	17.9
Interest Charges						
Interest on Long Term Debt	$3,286	$3,027	8.6	12,744	$11,766	8.3
Other Interest Expenses & Charges	275	242	13.6	1,146	1,355	(15.4)
Allowance for Borrowed Funds Used During Construction	(804)	(753)	6.8	(3,189)	(3,027)	5.4
Net Interest Expenses & Charges	$2,757	$2,516	9.6	$10,701	$10,094	6.0
Net Income Before Extraordinary Items	$5,297	$4,196	26.2	$18,986	$15,078	25.9
Extraordinary Items	18	1	NM	(258)	31	NM
Net Income	$5,315	$4,197	26.6	$18,728	$15,109	24.0
Preferred Dividends Declared	726	678	7.1	2,836	2,604	8.9
Net Income Available for Common	$4,589	$3,519	30.4	$15,892	$12,505	27.1
Common Dividends Declared	2,731	2,507	8.9	10,523	9,228	14.0
Retained Earnings	$1,858	$1,012	83.6	$5,369	$3,277	63.8
Earnings Per Share*	$0.91	$0.74	23.0	$3.24	$2.77	17.0
Common Dividends Per Share*	$0.54	$0.53	1.9	$2.14	$2.04	4.9

NOTE: The income statement is a "net" statement: the duplicative effect of including resale revenues has been eliminated.
*Based on average shares outstanding as reported to EEI by survey respondents and adjusted for stock splits.
(NM) Not Meaningful

Table 2
Investor-Owned Electric Utility Industry Balance Sheet
As of March 31, 1983 and 1984 (unaudited) (Millions of Dollars)

Assets	1984	1983	% Change
Utility Plant*			
Utility Plant (Including Nuclear Fuel)	$280,912	$254,595	10.3
Less Accumulated Depreciation	79,784	70,346	13.4
Less Property-Related Accumulated Deferred Income Taxes	4,511	3,113	44.9
Total	$196,617	$181,136	8.5
Construction Work in Progress	101,450	94,688	7.1
Net Utility Plant	$298,067	$275,824	8.1
Investments	6,748	5,950	13.4
Current Assets	34,350	31,217	10.0
Deferred Debits	13,420	7,614	76.3
Total Assets	$352,585	$320,605	10.0
Capitalization & Liabilities			
Capitalization			
Common Stock	$75,732	$68,479	10.6
Retained Earnings	37,128	31,890	16.4
Preferred Stock	31,960	30,125	6.1
Long-Term Debt	133,644	124,292	7.5
Total Capitalization	$278,464	$254,786	9.3
Current Liabilities			
Short-Term Debt	$4,779	$5,862	(18.5)
Long-Term Debt Due Currently	4,075	3,207	27.1
Other Current Liabilities	26,678	23,305	14.5
Total Current Liabilities	$35,532	$32,374	9.8
Deferred Credits			
Accumulated Deferred Income Taxes	$19,378	$17,311	11.9
Accumulated Deferred Investment Tax Credits	12,855	10,927	17.6
Other Deferred Credits	6,356	5,207	22.1
Total Deferred Credits	$38,589	$33,445	15.4
Total Capitalization & Liabilities	$352,585	$320,605	10.0

*Includes other utility plant of combination gas and electric companies.

Retained Earnings

Total capitalization increased 9.3 percent to $278 billion. Retained earnings, which reflect reinvestment of equity returns, increased 16.4 percent and have been growing at a greater annual rate since mid-1983 than any other component of the capital structure. The industry's equity ratio grew to 40.5 percent at March 31, 1984, while the long-term debt ratio fell to 48.0 percent. Even though certain state commissions have addressed increasing equity ratios and some companies have taken measures to constrain or reduce their equity ratios, certain segments of the industry continue to have heavy needs for new equity.

Interest charges on long-term debt totalled $3.3 billion in the first quarter of 1984, 8.6 percent higher than the first quarter of 1983. Pre-tax interest coverages continued to improve during the twelve months ending March 31, 1984, reaching 3.12 times (including AFUDC), a level not exceeded since 1970.

Despite the apparent improvement in the industry's financial performance, bond rating changes indicate a reduction in financial flexibility for many companies, particularly those with existing construction programs. During the first quarter of 1984, 15 electric utilities had their senior debt securities downgraded; only 6 were upgraded. Of those companies downgraded, 11 have *active* nuclear construction programs and average ratios of construction work in progress to total equity of 121 percent versus 20 percent for those companies which received increased ratings and 90 percent for the industry as a whole.

The financial distress of individual companies also had its impact on the industry's average common stock dividend. Actions taken by two companies during the first quarter of 1984 affected the industry's average common dividend increase, holding it to 1.9 percent. Excluding those companies, the average dividend was $0.53 in the first quarter of 1983 and $0.56 in the first quarter of 1984, an increase of 5.7 percent. The impact of subsequent dividend actions will be even greater in the second quarter of 1984.

Tables 1 and 2 are based on unaudited reports submitted by a sample of electric utilities. The utilities used in the sample account for 95 percent of the industry's revenue from sales to ultimate customers and 94 percent of the industry's total assets. The data was expanded to represent the entire investor-owned electric utility industry.

Contributed by the Finance Department of Edison Electric Institute.

TECHNOLOGY REVIEW

UTILITY COAL ASH

By Tobias Anthony

More than 800 million tons of utility coal ash are accumulated in disposal areas around the nation's coal-burning power plants. Some 70 million tons of this mineral were stockpiled in 1983 alone. And, within ten years, because of the increased use of coal to produce electricity, the annual production rate of coal ash is expected to reach 100 million tons.

Despite its abundance, however, coal ash remains an undiscovered resource in America. If utilized, it could contribute importantly, for example, to increasing the tax base for financially strapped communities, to lowering the costs of constructing highways and bridges, to offsetting the constant depletion of valuable agricultural soils, and to a variety of as yet unresearched purposes. For the nation's electric utilities, coal ash offers a source of revenue not fully realized as well.

Once, it was the dream of the oil industry to utilize every drop of oil that came out of the ground. This has been accomplished. But with coal and coal ash, the story is different. Despite its low cost, availability, and multiple known uses, only 20 percent of coal ash is utilized, primarily in low-volume cement replacement applications.

REVIEWS

In 1985, more than half of the electric energy generated and used in the United States will be produced by utility companies burning 633 million tons of coal—an estimated two-thirds of this country's annual coal-burn. The resulting ash will amount to the nation's fourth largest mineral resource, surpassed in availability only by stone, sand, and coal. Because utilities have placed ash in central disposal sites, these huge quantities are available for above-ground "mining."

As it is produced, coal ash is either "fly ash," the fine, powder-like substance caught in special collectors, or "bottom ash" or "boiler slag," the coarser, heavier material that falls to the bottom of the giant coal burning furnaces. Fly ash, which represents about three-fourths of the total mineral, is the most versatile in applied uses.

For example, fly ash can be utilized in: brick manufacture, roofing felt, mineral-wool insulation, highway sub-grading, metal reclamation, fighting forest fires, controlling mine subsidence, asphaltic concrete admixture, absorbing oil spills, dewatering sewage sludge, improving sand moldings, sanitary landfill cover, and structural fill.

Bottom ash can be used for: sand blasting grits, water treatment filtration, road de-icing, cold mix asphalt, and structural fills.

The safe, controlled use of coal ash has received the endorsement of the U.S. Environmental Protection Agency, which says, "any purchase of cement or concrete made with Federal funds, either directly or indirectly, should specifically allow for fly ash to be used as an optional or alternate material, unless it can be shown that the use of fly ash is technically inappropriate for a particular construction application."

The Federal Highway Administration of the U.S. Department of Transportation states that the greater utilization of coal ash is a "more prudent use of our resources that is both economically desirable and technically feasible."

In Washington, D.C., the National Ash Association has analyzed present-day uses of coal ash, and projected future utilization in order to provide guidelines aimed at total use of the product. At present, the primary use of the mineral is in the production of high-quality (pozzolan) cement. But the potential for utilization in land re-development, soil stabilization, agricultural applications, road-base construction, and other smaller volume uses is significant.

An imaginative and precedent-setting demonstration of high-volume ash utilization has recently been initiated in Maryland by the Baltimore Gas & Electric Company (BG&E). More than 200 acres of land with marginal development potential will be filled during the next 10 years with an astonishing 1.8 million tons of coal ash to develop a new, high-value office and industrial park. This forward-looking project not only allows for maximum use of the company's coal ash resource, but also creates finished industrial park building sites that will be valued at an estimated 7 to 10 times their purchase price. BG&E's ash utilization venture represents both a valuable improvement for the utility and a significant community project that will generate a positive impact on the local tax base.

In Montgomery, West Virginia, the Appalachian Power Company used 350,000 tons of fly ash to stabilize a low-lying housing development site 15 miles from a coal-burning electricity-generating plant. The ash fill ranged in depth from 3 to 11 feet and was covered with a foot of top soil. The building lots were approved for FHA financing for the construction of homes.

Not far away, the West Virginia State Department of High-

ways was completing 80 miles of secondary road construction utilizing more than 100,000 tons of "ashphalt" paving material made from the coarser boiler slag/bottom ash generated at nearby coal-burning plants. Compared to using traditional resources, a substantial cost saving was realized at this project, and the material proved easier to handle since it is applied cold and weather was not a deterring factor on the job.

And in Morgantown, West Virginia, in a demonstration showing the viable utilization of coal ash in agricultural applications, the U.S. Energy Research Center reclaimed an acid-surface mine spoil site that was totally absent of any natural vegetation. In this project, fly ash was spread at rates of 150 tons an acre and, after fertilization and seeding, grass and hay yields from the field were comparable to averages throughout the state. The fly ash use was shown to be effective in resolving the acid/alkaline balance problem, as well as enhancing the water holding capacity and improving soil texture. A similar farm land enhancement program was accomplished with equal success recently in Michigan by the Lansing Board of Water and Light.

Utilization of coal ash has been held back by a number of factors. The "we've always used cement, stone, and gravel, so we keep on doing that" concept has resulted in serious lack of awareness of ash advantages by some prospective users. Among utilities, it previously was more economic to simply stockpile the ash, rather than market it. Now, higher coal prices, higher prices for sand and gravel, and the utilities' financial situations are changing that.

The available inventory of coal ash, and the continuous generation of even greater quantities of this mineral, represents an asset that should not become a liability. As more and more coal ash is utilized, stockpiling problems are eliminated, other natural resources are preserved, and high-value and high quality developments and products are created—an unusual phenomenon of all positives.

Tobias Anthony is President of the National Ash Association.

BOOK REVIEW

SUPERMANAGING: HOW TO HARNESS CHANGE FOR PERSONAL AND ORGANIZATIONAL SUCCESS

Arnold Brown and Edith Weiner
McGraw-Hill, 1984
New York, 283 pp.

By Sue Lerner

Arnold Brown and Edith Weiner, authors of the best-selling *Supermanaging*, are among a growing number of professionals whose job it is to teach us how to do our jobs. For fifteen years, Brown and Weiner have been in the business of minding other people's business. Clients, ranging from Fortune 500 corporations to government agencies and academic institutions, have hired the authors to make their organizations more efficient and productive. *Supermanaging* draws on this practical experience, but the authors are not content to write the usual step-by-step primer for success. They attempt to unravel the complex and comprehensive matrix of

factors that are shaping the future of American business.

Supermanaging takes its place among a growing variety of books that tell us how to think, dress, eat, or, in this case, "harness change" for success. The sheer number of these "self-help" books underscores one of Brown and Weiner's most basic premises: the world is an uncertain place, though its inhabitants have a natural desire for certainty. A desire for stability and permanence dictates the need for all sorts of blueprints, theories, and maps that promise to chart a clear course toward success and security. *Supermanaging* offers no such clear-cut route to success because, the authors argue, it is impossible to determine exactly what the nature of success will be in the years to come. If Brown and Weiner provide no map, they do try to give managers a kind of compass by which to steer among those forces that currently threaten to sink the corporate ship.

Supermanaging focuses on how to deal with and master change. The supermanager succeeds not despite change, but because of it. He or she is not intimidated or threatened, but rather "invigorated by the pace, nature, magnitude, and promise of change." Success stems from an ability to resist the lulling effects of social institutions and the tendency to regard such institutions as permanent and invulnerable. Future failures will be inevitable, according to the authors, if today's managers continue to use the traditional, shortsighted methods of the past for gauging what will happen in the future.

A major problem for the potential supermanager is the fact that American institutions have come to base their analyses of the world on increasingly large amounts of quantitative data—from government surveys, consulting firms, computerized systems, and other data-collection sources that monitor practically every aspect of today's business world. The weight and solidity of such documentation leads us to believe that the numbers are real, "not just symbols representing parts of reality." Actual events develop in spite of the data, regardless of it, and even counter to its apparent message because the world we are measuring is increasingly irrational and unmeasurable. As a result, such data are no true guide to the real world in which real people live, produce, and consume.

To readdress this problem, Brown and Weiner sketch a broad picture of the social, economic, political, and technological forces that, in their opinion, are shaping today's environment and that of the future. *Change* is the key element in every circumstance, and the forces of change are, perhaps, more subtle and pervasive than they might appear on the surface. For example, much has been made of the new baby boom that is now underway as the women born during the baby boom of the 1950s are now themselves of childbearing age. According to the most widely held image, today's mothers are very different from the mothers of the earlier generation: they are better educated, have fewer children, and are much more likely to be in the labor force. The "new" family has on the average fewer than two children, and research indicates that an only child fares better than children in general when it comes to intelligence, achievement, relations with adults, and educational goals. Given this rosy scenario, the new boom of babies may mean a future work force with a high proportion of self-reliant and achievement-oriented workers.

However, the new baby boom is not only a product of more affluent, upscale couples, as many market research studies would have us believe. It is also the product of poorer, less-educated, unstable youth—as evidenced by the epidemic of teenage pregnancies. Managers will have to consider the pressures of housing, work schedules, and limited social

and public funds, not to mention the potential for class conflict over education and health care as the result of this other and sizeable segment of new mothers. How their children will grow up to influence the work force is even more problematic.

Demographics is only one of a number of factors that the authors examine as forces of change. The others include locomotive technologies, economic transition, and the changing social and political climate. By their own admission, Brown and Weiner provide only the most broad and general discussion of these forces. Implicit in the authors' premise is the belief that merely knowing such forces exist is not enough; one must be prepared to act on this knowledge. As an example, the authors suggest that society in the future may become increasingly divided along the lines of access to and skill with information technologies now considered revolutionary. If information becomes wealth and access to information becomes power, then those who possess that wealth and power may be tomorrow's aristocrats. To be among this future elite, one must be involved *today* in the design and use of the technologies of tomorrow.

The authors' general advice for coping with change can be summed up in the old maxim about keeping your options open. For today's managers who want to be tomorrow's supermanagers, this means not relying on most other old maxims. Don't limit the definition of your business—diversify. Don't trust traditional economic indicators—an informed hunch is sometimes better than a stock market analysis. Don't think that more money will solve all your business troubles—bigger is not necessarily better. And don't believe the promises of those other best-selling books that cite ten easy steps to success—Brown and Weiner are selling a "philosophy," not a formula.

Part of that philosophy involves learning to forget. Too often organizations try to incorporate new systems merely by heaping them on top of old ones, attempting to accommodate all the baggage acquired in all previous trips through the process of change. The supermanager knows how to clean out the corporate closet. To cling to outmoded methods of manufacturing, old product lines, markets, and attitudes is to let newcomers race ahead. Completely new enterprises have nothing to forget, and sometimes that means a greater chance for future success.

Traditional notions about success itself can become a stumbling block. Money, power, fame—the usual trappings of success may involve less glamorous side-effects, like ulcers, divorce, personal disillusionment. While most of us would probably be happy to take our chances with money, power, and fame, few of us will have the opportunity. However, as Brown and Weiner point out, all of us can and should evaluate what success means for us and structure our lives and businesses to achieve these personal goals, not some arbitrary standard.

There are as many kinds of success as there are different kinds of people, and the authors stress that there are an equally great number of ways to achieve success. Supermanaging is a matter of individual style; it's an art, not a science. Even when the authors examine the critical factors influencing management in the future, they focus on broad concepts (vulnerability, legitimacy, morality, transition) and general advice. Anyone looking for a quick management fix will not find it here. Instead, the authors prod our preconceptions about the whole nature of management in an attempt to extend our ways of thinking and arouse our own creative resources.

As a metaphor for society's historical inability to cope with change, Brown and Weiner use the following little parable:

Prior to World War II, an American general observing British army maneuvers

noted that mobile artillery pieces were served by seven soldiers, one of whom did nothing but stand at attention while the other six readied and fired the gun. Upon inquiring, he discovered that no one could tell him what the seventh man was for. Intrigued, he pursued the matter until he found out that in the old days, before trucks, the seventh man held the horses. The horses went, but the structure, now useless and wasteful, remained.

The illustration is, perhaps, even more apt than the authors intended. They exhort the reader to understand that planning for change is more than a new discipline—"it's a whole new philosophy." Be assured, however; the authors of *Supermanaging* foresee no genuinely revolutionary change, philosophic or otherwise. One is unlikely to question the expediency and meaningfulness of a job when it is one's own.

The authors' major contribution is to raise some interesting questions and explore a wide variety of issues, often in surprising and illuminating ways, and to provide a useful tool for comprehending the environment to deal optimally with change.

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STATISTICAL REVIEW

FIRST QUARTER SALES OF ELECTRICITY UP 11.3 PERCENT

Sales of electricity reported by the investor-owned electric utility industry for the first quarter of 1984 were 11.3 percent greater than in the first quarter of 1983. As in recent quarters, strong gains in the economy-sensitive industrial sales led the increase; however, the increased sales in the weather-sensitive residential sector served to narrow the difference in contribution that each sector made. In all, the industry sold 440 million megawatthours (MWH) in the first quarter of 1984, 45 million MWH more than in the first quarter of 1983. On an annual basis, sales were up 7.2 percent for the year ending March 31, 1984, outpacing, for now at least, most growth forecasts. Customer growth in the first quarter showed moderate gains, increasing 1.8 percent over the first quarter of 1983.

Increased MWH sales of electricity to ultimate customers, both during the quarter and the twelve months ending March 31, 1984, have been driven to a great extent by the economic recovery. Sales to industrial customers increased 12.8 percent in the first quarter of 1984, compared to an 11.1 percent increase in sales to residential customers during a quarter which was colder than the comparable quarter of 1983. Sales to commercial customers were 10.0 percent higher in the first quarter of 1984, a lower relative increase than the other major customer classes despite having a greater relative increase in its customer base.

For the twelve months ending March 31, 1984, sales to ultimate customers increased 7.2 percent to 1,683 million MWH from 1,570 million MWH during the year ending March 31, 1983. As in the case of the quarterly sales increases, sales to industrial customers for the twelve month period increased at a greater rate than the other major customer classes and accounted for 40.4 percent of the increase in total sales to ultimate customers. Industrial sales accounted for the greatest percentage of increase in total sales in three of the four quarters of the year ending March 31, 1984.

During the first quarter of 1984, the average increase in the Federal Reserve Board Index of Industrial Production (less electricity component) over the first quarter of 1983 was 15.8 percent, compared to an average increase in the fourth quarter of 1983 of 15.4 percent. However, on a monthly basis, the Index peaked in February with an average increase of 16.2 percent and increased at a decreasing rate in March and April when the average increase was 14.9 percent.

Contributed by the Statistics Department of Edison Electric Institute.

Table 1
Customer, Sales, and Revenue Data
Investor-Owned Electric Utilities

	Quarter Ending March 31,			Year Ending March 31,		
	1984	1983	% Increase	1984	1983	% Increase
Number of Customers						
Residential	65,990,420	64,886,054	1.7	65,417,730	64,450,376	1.5
Commercial	7,908,438	7,725,337	2.4	7,854,893	7,685,365	2.2
Industrial	387,514	385,296	0.6	391,035	384,526	1.7
Street & Highway	111,440	114,013	(2.3)	113,806	112,931	0.8
Other Public Auth	137,466	136,743	0.5	138,471	136,480	1.5
Railroads	23	23	0.0	23	23	0.0
Interdepartmental	623	486	28.2	529	465	13.8
Total Customers	74,535,924	73,247,952	1.8	73,916,487	72,770,166	1.6
Electricity Sales (MWH)						
Residential	155,679,023	140,153,665	11.1	560,870,778	521,080,884	7.6
Commercial	114,819,953	104,418,426	10.0	454,959,759	428,553,097	6.2
Industrial	155,621,943	137,965,252	12.8	613,836,961	568,184,147	8.0
Street & Highway	2,711 533	2,812,283	(3.6)	10,355,528	10,603,339	(2.3)
Other Public Auth	10,283,992	9,048,346	13.7	37,618,659	36,479,256	3.1
Railroads	542,403	500,204	8.4	1,971,426	1,896,163	4.0
Interdepartmental	736,772	701,230	5.1	3,019,057	2,936,658	2.8
Total Sales (MWH)	440,395,619	395,599,406	11.3	1,682,632,168	1,569,733,544	7.2
Revenues ($000)						
Residential	$10,823,133	$9,478,828	14.2	$40,411,735	$36,112,348	11.9
Commercial	7,995,230	7,174,372	11.4	32,172,006	29,582,515	8.8
Industrial	7,628,136	6,831,357	11.7	30,079,033	28,244,923	6.5
Street & Highway	274,553	270,182	1.6	1,062,848	989,878	7.4
Other Public Auth	525,574	448,596	17.2	1,973,213	1,788,460	10.3
Railroads	35,818	32,832	9.1	129,285	127,589	1.3
Interdepartmental	26,849	23,352	15.0	105,950	100,831	5.1
Total Revenues*	$27,309,293	$24,259,519	12.6	$105,934,070	$96,946,544	9.3

*Includes sales to ultimate customers only.

REVIEWS

REGULATORY REVIEW

SMALL SCALE HYDRO

Regulatory relief, market guarantees, and tax incentives enacted by Congress since 1978 have encouraged the development of small scale hydroelectric projects. Between 1977 and 1981, a thousand-fold increase in preliminary permit applications occurred. Projects are now moving to construction, and as many as 400 new projects are scheduled to be operating by 1987. These, and the attention that has been drawn to the relicensing of existing projects by the preference controversy, have heightened the interest in the environmental implications of hydropower development.

In a roughly 70-page enclosure to a letter to Congressman Richard Ottinger (D-NY), dated February 17, 1984, Raymond J. O'Connor, Chairman of the Federal Energy Regulatory Commission (FERC), responded to a host of questions concerning small hydroelectric projects. Many of the questions focused on such topics as cumulative environmental impacts, compliance with the National Environmental Policy Act, impacts on fish, wildlife and other environmental values, and consistency with comprehensive state river basin plans.

These questions and answers proved to be the precursors to oversight hearings on the FERC's small hydro program held before the House Energy and Commerce Committee's Subcommittee on Energy Conservation and Power on September 11, 1984. At the hearings, Chairman O'Connor provided an update to his earlier response to Congressman Ottinger. His testimony also highlighted recent court and Commission decisions affecting small hydro development and discussed drawbacks of proposals to transfer the FERC's comprehensive planning and licensing functions to state or regional bodies. Chairman O'Connor spoke of a need for legislation to strengthen FERC's license revocation authority. He also suggested the need for congressional scrutiny of the notice provisions of the Federal Power Act and state water quality certification under section 401(a) of the Clean Water Act, to ensure that it is not used improperly by states to veto hydropower development.

Close on the heels of Chairman O'Connor's February letter, Senator George Mitchell (D-ME) introduced S. 2361, the "State Comprehensive River Planning Act." The bill would authorize development of state comprehensive river basin plans to be approved by FERC. Applicants for hydroelectric project licenses would be required to certify that the proposed project complied with the state plan. More recently, on September 6, 1984, Congressman James Jeffords (R-VT) introduced a bill (H.R. 6198) that would amend the Federal Power Act to delegate the authority to license small hydro projects to the states. In each instance, the legislation would significantly increase the state role in licensing hydroelectric projects.

FERC's comprehensive role in licensing hydroelectric projects and conditioning them to protect the public interest was narrowed somewhat by a May 1984 decision by the U.S. Supreme Court. In *Escondido Mutual Water Co.* v. *LaJolla Band of Mission Indians,* the Court agreed with the U.S. Court of Appeals for the Ninth Circuit on an important issue: in an original license for a hydroelectric project FERC, under section 4(e) of the Federal Power Act, must accept, without modification, conditions that the Secretary with jurisdiction over a federal reservation (such as Indian lands or national forests) deems necessary to

protect the reservation. This decision gives those Secretaries the upper hand in protecting environmental and other values on the federal reservations. But, the impact of this holding is limited because the Court expressly declined to decide whether the section 4(e) provision applies to relicensing proceedings.

On another front, the FERC has voluntarily limited its role under section 30(c) of the Federal Power Act in assessing the environmental effects on fish and wildlife resources of projects proposed for licensing exemptions. In *Olympus Energy Corporation,* the Commission held that the Public Utilities Regulatory Policies Act (PURPA) gave the U.S. Fish and Wildlife Service and state fish and game agencies the exclusive authority and responsibility to determine an exempted project's impact on fish and wildlife resources and to prescribe measures to counter any adverse impacts. FERC reserved for itself the role of determining whether the proposed project meets exemption criteria and of weighing non-fish and wildlife public interest concerns.

In the relicensing of existing hydroelectric projects, a June 1984 decision from the U.S. Court of Appeals for the Ninth Circuit will have a marked impact on the relicensing process if the decision is not reversed. In *Confederated Tribes and Bands of the Yakima Nation v. FERC,* the court ruled that FERC (1) failed to fulfill its statutory obligations to consider and adopt measures to mitigate the effect of the project on fisheries and (2) erred in not preparing an environmental impact statement [EIS] under the National Environmental Policy Act prior to issuing the new license.

FERC, in asking that the case be reheard, characterizes these holdings as "in effect, reading 'reopener clauses' out of Section 6 of the Federal Power Act and adopting an automatic EIS requirement as to all relicensing cases under the act."

The environmental concerns in *Yakima* were advanced by the petitioning Indian tribes and the National Marine Fisheries Service and by intervenors in the proceeding, the Washington State Departments of Fisheries and of Game and the National Wildlife Federation. The National Wildlife Federation, along with other Indian tribes, also participated in *Tulalip Tribes of Washington v. FERC,* a case that invalidated the FERC definition of a natural water feature exemption. The *Tulalip* court held that under PURPA only those projects that do not require a dam or impoundment are eligible for a natural water feature exemption.

The involvement of environmentally concerned parties and intervenors in cases such as these, and the interest of some environmental organizations in the hydro relicensing legislation pending in Congress, indicate a trend that may become increasingly apparent in future relicensing cases. Organizations and government agencies having environmental protection as their mission may well seize the opportunity afforded by relicensing proceedings to seek terms and conditions to protect fish, wildlife, and other environmental values in new licenses for projects built years ago. FERC, working with other federal and state agencies, intervenors and applicants, will have the delicate task of striking a balance between the power potential of these projects and protection of important environmental values.

Contributed by the office of the General Counsel, Edison Electric Institute.

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